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FORM OF ENTRY

All entries in *Physics Abstracts* follow the same basic pattern. The following example identifies the individual parts of a typical entry for an article from a journal.

Entry No. in PA ↓ **Title of paper** ↓

87093 PAC study of molecular rotational motions in dilute solutions.
Authors → A.Baudry, P.Boyer, J.D.Fabris, P.Vulliet (Lab. d'Interactions Hyperfines, CENG, Grenoble, France). ← **Author's affiliation**
Source of paper → *Hyperfine Interactions (Netherlands)*, vol.10, no.1-4, p.1057-62 (June 1981). (Proceedings of the Fifth International Conference on Hyperfine Interactions, Berlin, Germany, 21-25 July 1980).
The rotational tumbling of neutral chelates of hafnium dissolved in several organic solvents was studied via ^{181}Ta DPAC experiments. The results are compared with the predictions of a hydrodynamic model with partial slip boundary conditions. The influence of solute-solvent interactions and/or associations on the quadrupole relaxation is discussed. (16 refs.) } **Abstract**

Entries for other types of material differ mainly in the reference to the source, e.g., a report will refer to the report series and the number of the individual report. A conference paper on the other hand will normally refer to the title, place and date of the conference at which the paper was given.

SUBJECT ARRANGEMENT & SUBJECT GUIDE

The abstracts are arranged by subject in accordance with the scheme in the CLASSIFICATION and CONTENTS which appears opposite. The page number for the start of each subject section is given. An alphabetical index to the scheme—the SUBJECT GUIDE—follows the CLASSIFICATION and CONTENTS.

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At the end of each issue, an alphabetical index of authors is provided showing the entry number of the items written by them. These indexes are cumulated every six months and, with the addition of the title of the individual papers, are published separately to cover the periods January-June and July-December of each year.

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Where appropriate, the following subsidiary indexes are included for the convenience of users:

Bibliography index of articles where a significant list of references or bibliography is contained.

Book index of books received and abstracted.

Corporate Author index where a corporate organisation rather than an individual is responsible for publication. This index includes all reports.

Conference index with reference to individual papers.

Subscription prices and ordering procedure are shown on the inside back cover.

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CLASSIFICATION AND CONTENTS

The abstracts are arranged by subject in accordance with the following scheme. The page number for each section is given. The CLASSIFICATION AND CONTENTS is followed by an alphabetical guide to the scheme, the SUBJECT GUIDE.

The classification scheme is the result of cooperation between INSPEC, the American Institute of Physics, the European Physical Society and the Physics Working Group of the ICSU-AB.

		page
0000	**GENERAL**	5585
0100	COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY	5585
0110	Announcements, news, and organizational activities	—
0130	Physics literature and publications	5585
0130B	*Publications of lectures (advanced institutes, summer schools, etc.)*	—
0130C	*Conference proceedings*	5585
0130E	*Monographs, and collections*	5586
0130K	*Handbooks, dictionaries, tables and data compilation*	5586
0130M	*Textbooks for graduates and researchers*	5586
0130P	*Textbooks for undergraduates*	5586
0130R	*Surveys and tutorial papers; resource letters*	5587
0130T	*Bibliographies*	5587
0140	Education	5587
0150	Educational aids	5587
0155	General Physics	5589
0160	Biographical, historical, and personal notes	—
0165	History of science	5589
0170	Philosophy of science	5590
0175	Science and society	5590
0190	Other topics of general interest	—
0200	MATHEMATICAL METHODS IN PHYSICS	5590
0210	Algebra, set theory, and graph theory	5590
0220	Group theory	5590
0230	Function theory, analysis	5590
0240	Geometry, differential geometry, and topology	5591
0250	Probability theory, stochastic processes, and statistics	5591
0260	Numerical approximation and analysis	5591
0270	Computational techniques	5592
0290	Other topics in mathematical methods in physics	—
0300	CLASSICAL AND QUANTUM PHYSICS; MECHANICS AND FIELDS	5592
0320	Classical mechanics of discrete systems: general mathematical aspects	5592
0330	Special relativity	5592
0340	Classical mechanics of continuous media: general mathematical aspects	5593
0340D	*Mathematical theory of elasticity*	5593
0340G	*Fluid dynamics: general mathematical aspects*	5594
0340K	*Waves and wave propagation: general mathematical aspects*	5594
0350	Classical field theory	5594
0365	Quantum theory; quantum mechanics	5595
0370	Theory of quantized fields	5596
0380	General theory of scattering	5596
0400	RELATIVITY AND GRAVITATION	5596
0420	General relativity	5596
0430	Gravitational waves and radiation: theory	5597
0440	Continuous media; electromagnetic and other mixed gravitational systems	5597
0450	Unified field theories and other theories of gravitation	5597
0460	Quantum theory of gravitation	5598
0465	Supergravity	5598
0480	Experimental tests of general relativity and observations of gravitational radiation	5598
0490	Other topics in relativity and gravitation	—
0500	STATISTICAL PHYSICS AND THERMODYNAMICS	5599
0520	Statistical mechanics	5599
0530	Quantum statistical mechanics	5599
0540	Fluctuation phenomena, random processes, and Brownian motion	5599
0550	Lattice theory and statistics; Ising problems	5600
0560	Transport processes: theory	5601
0570	Thermodynamics	5602
0590	Other topics in statistical physics and thermodynamics	—
0600	MEASUREMENT SCIENCE, GENERAL LABORATORY TECHNIQUES, AND INSTRUMENTATION SYSTEMS	5602
0620	Metrology	5602
0620D	*Measurement and error theory*	5602
0620F	*Units*	5602
0620H	*Measurement standards and calibration*	5602
0620J	*Determination of fundamental constants*	—
0630	Measurement of basic variables	5603
0630C	*Spatial variables measurement*	5603
0630E	*Mass and density measurement*	5603
0630F	*Time and frequency measurement*	5603
0630G	*Velocity, acceleration and rotation measurement*	5604
0630L	*Measurement of basic electromagnetic variables*	5604
0650	Data handling and computation	5604
0660	Laboratory techniques	5604
0670	General instrumentation	5604
0690	Other topics in measurement science, general laboratory techniques and instrumentation systems	—
0700	SPECIFIC INSTRUMENTATION AND TECHNIQUES OF GENERAL USE IN PHYSICS	5605
0710	Mechanical instruments and measurement methods	5605
0720	Thermal instruments and techniques	5605
0720D	*Thermometry*	5605
0720F	*Calorimetry*	5605
0720H	*Furnaces*	—
0720K	*High-temperature techniques and instrumentation; pyrometry*	5605
0720M	*Cryogenics*	5605
0725	Hygrometry	—
0730	Vacuum production and techniques	5606
0730C	*Vacuum pumps*	5606
0730D	*Vacuum meters*	5606
0735	High pressure production and techniques	5606
0750	Electrical instruments and techniques	5606
0755	Magnetic instruments and techniques	5607
0758	Magnetic resonance spectrometers, auxiliary instruments and techniques	5607
0760	Optical instruments and techniques	5608
0760D	*Photometry and radiometry*	5608
0760F	*Polarimetry and ellipsometry*	5608
0760H	*Refractometry and reflectometry*	5608
0760L	*Interferometry*	5609
0760P	*Optical microscopy*	—
0762	Detection of radiation (bolometers, photoelectric cells, i.r. and submillimetre waves detection)	5609
0765	Optical spectroscopy and spectrometers	5609
0765E	*UV and visible spectroscopy and spectrometers*	5610
0765G	*IR spectroscopy and spectrometers*	5610
0768	Photography, photographic instruments and techniques	5610
0775	Mass spectrometers and mass spectrometry techniques	5611
0777	Particle beam production and handling; targets	5611
0780	Electron and ion microscopes and techniques	5612
0785	X-ray, gamma-ray instruments and techniques	5612
0790	Other topics in specialised instrumentation	—
1000	**THE PHYSICS OF ELEMENTARY PARTICLES AND FIELDS**	5613
1100	GENERAL THEORY OF FIELDS AND PARTICLES	5613
1110	Field theory	5613
1120	S-matrix theory	5617
1130	Symmetry and conservation laws	5617
1140	Currents and their properties	5619
1150	Dispersion relations and sum rules	5619
1160	Complex angular momentum; Regge formalism	5619
1180	Relativistic scattering theory	—
1190	Other topics in general field and particle theory	—
1200	SPECIFIC THEORIES AND INTERACTION MODELS; PARTICLE SYSTEMATICS	5619
1210	Unified field theories and models	5619
1220	Models of electromagnetic interactions	5621
1220D	*Specific calculations and limits of quantum electrodynamics*	5621
1220F	*Experimental tests of quantum electrodynamics*	—
1225	Models for gravitational interactions	5621
1230	Models of weak interactions	5621
1235	Composite models of particles	5622
1235C	*General properties of quantum chromodynamics (dynamics, confinement, etc.)*	5622
1235E	*Applications of quantum chromodynamics to particle properties and reactions*	5623
1235H	*Phenomenological composite models of particle structure and reactions (partons, bags, etc.)*	5623
1235K	*Other composite models*	5625

page
1240 Models of strong interactions 5625
1240E *Statistical models* 5625
1240F *Bootstrap models* —
1240H *Duality and dual models* 5625
1240K *Hadron classification schemes* —
1240M *Complex angular momentum plane; Regge poles and cuts (Reggeons)* 5625
1240P *Absorptive, optical, and eikonal models* 5625
1240Q *Potential models* 5625
1240R *Peripheral models (one or more particle exchange)* —
1240S *Multiperipheral and multi-Regge models* 5625
1240V *Vector-meson dominance* 5625
1270 Hadron mass formulas 5625
1290 Miscellaneous theoretical ideas and models 5625

1300 SPECIFIC REACTIONS AND PHENOMENOLOGY 5625
1310 Weak and electromagnetic interactions of leptons 5625
1315 Neutrino interactions 5625
1320 Leptonic and semileptonic decays of mesons 5626
1325 Hadronic decays of mesons 5626
1330 Decays of baryons 5626
1335 Decays of leptons 5627
1340 Electromagnetic processes and properties 5627
1340D *Electromagnetic mass differences* 5627
1340F *Electromagnetic form factors; electric and magnetic moments* 5627
1340H *Electromagnetic decays* 5627
1340K *Electromagnetic corrections to strong and weak interaction processes* 5627
1360 Photon and charged-lepton interactions with hadrons 5627
1360F *Elastic and Compton scattering* —
1360H *Total and inclusive cross sections* 5627
1360K *Meson production* —
1360M *Meson-resonance production* —
1360P *Baryon and baryon resonance production* 5627
1365 Hadron production by electron-positron collisions 5628
1375 Hadron-induced low- and intermediate-energy reactions and scattering, energy ≤ 10 GeV 5628
1375C *Nucleon-nucleon interactions, including antinucleon, deuteron, etc. (energy ≤ 10 GeV)* 5628
1375E *Hyperon-nucleon interactions (energy ≤ 10 GeV)* —
1375G *Pion-baryon interactions (energy ≤ 10 GeV)* 5628
1375J *Kaon-baryon interactions (energy ≤ 10 GeV)* 5628
1375L *Meson-meson interactions (energy ≤ 10 GeV)* —
1385 Hadron-induced high- and super-high-energy interactions, energy > 10 GeV 5628
1385D *Elastic scattering (energy > 10 GeV)* 5628
1385F *Inelastic scattering, two-particle final states (energy > 10 GeV)* 5629
1385H *Inelastic scattering, many-particle final states (energy$>$10GeV)* 5629
1385K *Inclusive reactions, including total cross sections, (energy > 10 GeV)* 5629
1385M *Cosmic ray interactions* 5629
1388 Polarisation in interactions and scattering 5629
1390 Other topics in specific reactions and phenomenology of elementary particles 5630

1400 PROPERTIES OF SPECIFIC PARTICLES AND RESONANCES 5630
1420 Baryons and baryon resonances 5630
1440 Mesons and meson resonances 5630
1460 Leptons 5630
1480 Other and hypothetical particles 5630

2000 **NUCLEAR PHYSICS** 5631

2100 NUCLEAR STRUCTURE 5631
2110 General and average properties of nuclei; properties of nuclear energy levels 5631
2110D *Binding energy and masses* 5632
2110F *Shape, charge, radius and form factors* 5632
2110H *Spin, parity, and isobaric spin* 5633
2110J *Spectroscopic factors* 5633
2110K *Electromagnetic moments* 5633
2110M *Level density and structure* 5633
2130 Nuclear forces 5633
2140 Few-nucleon systems 5634
2160 Nuclear-structure models and methods 5634
2160C *Shell model* 5634
2160E *Collective models* 5634
2160F *Models based on group theory* 5634
2160G *Cluster models* 5635
2160J *Hartree-Fock and random-phase approximations* 5635
2165 Nuclear matter 5635
2180 Hypernuclei 5635
2190 Other topics in nuclear structure —

2300 RADIOACTIVITY AND ELECTROMAGNETIC TRANSITIONS 5635
2320 Electromagnetic transitions 5635
2320C *Lifetimes and transition probabilities* 5636
2320N *Internal conversion and extranuclear effects* 5636
2340 beta decay; electron and muon capture 5636

page
2360 alpha decay 5637
2390 Other topics in nuclear decay and radioactivity 5637

2400 NUCLEAR REACTIONS AND SCATTERING: GENERAL 5637
2410 Nuclear reaction and scattering models and methods 5637
2410H *Optical and diffraction models* 5639
2430 Resonance reactions and scattering 5639
2450 Direct reactions 5639
2460 Statistical theory and fluctuations 5639
2470 Polarization in reactions and scattering 5640
2475 General properties of fission 5640
2490 Other topics in nuclear reactions and scattering, general —

2500 NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS 5640
2510 Nuclear reactions and scattering involving few-nucleon systems 5640
2520 Photonuclear reactions and photon scattering 5640
2530 Lepton-induced reactions and scattering 5640
2540 Nucleon-induced reactions and scattering 5641
2550 ^{2}H- and ^{3}H-induced reactions and scattering 5642
2560 ^{3}He- and ^{4}He-induced reactions and scattering 5642
2570 Heavy ion induced reactions and scattering 5642
2580 Meson- and hyperon-induced reactions and scattering 5647
2585 Fission reactions 5647
2588 Fusion reactions 5647
2590 Other topics in nuclear reactions and scattering: specific reactions —

2700 PROPERTIES OF SPECIFIC NUCLEI LISTED BY MASS RANGES 5648
2710 $A \leq 5$ 5648
2720 $6 \leq A \leq 19$ 5648
2730 $20 \leq A \leq 38$ 5648
2740 $39 \leq A \leq 58$ 5648
2750 $59 \leq A \leq 89$ 5649
2760 $90 \leq A \leq 149$ 5649
2770 $150 \leq A \leq 189$ 5649
2780 $190 \leq A \leq 219$ 5649
2790 $220 \leq A$ 5650

2800 NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES 5650
2820 Neutron physics 5650
2841 Fission reactor theory and design 5650
2842 Fission reactor materials 5650
2842H *Fuel preparation and reprocessing* 5655
2843 Fission reactor operation 5656
2844 Fission reactor protection systems, safety and accidents 5656
2850 Fission reactor types and applications 5657
2852 Fusion reactors 5657
2858 Integrated reactor systems —
2870 Nuclear explosions 5657
2880 Radiation technology, including shielding 5657
2890 Other topics in nuclear engineering and nuclear power studies 5658

2900 EXPERIMENTAL METHODS AND INSTRUMENTATION FOR ELEMENTARY-PARTICLE AND NUCLEAR PHYSICS 5658
2910 Preacceleration (injection) —
2915 Electrostatic and linear particle accelerators 5658
2920 Cyclic accelerators and storage facilities 5658
2925 Particle sources and targets, preparation and technology 5658
2930 Radiation spectrometers and spectroscopic techniques 5658
2940 Radiation detectors 5659
2960 Counting circuits and nuclear electronics 5659
2970 Radiation measurement, detection and counting 5660
2975 Polarization analysis —
2980 Nuclear information processing —
2990 Other topics in high-energy and nuclear experimental methods and instrumentation —

3000 **ATOMIC AND MOLECULAR PHYSICS** 5660

3100 THEORY OF ATOMS AND MOLECULES 5660
3110 General theory of structure, transitions and chemical binding 5660
3115 General mathematical and computational developments 5660
3120 Specific calculations and results 5660
3120D *Complete ab initio calculations (exact or nearly exact calculations on small species)* —
3120E *Ab initio LCAO and GO SCF calculations* —
3120G *Other accurate, or nearly ab initio calculations (DIM method, SAMO method, etc.)* 5661
3120L *Statistical model calculations (Thomas-Fermi and Thomas-Fermi-Dirac models)* 5661
3120N *Semi-empirical NDO calculations (CNDO, INDO, MINDO, PCILO methods, etc.)* 5661

page
3120P *Other semi-empirical calculations (Hückel, generalized Hückel, PPP methods, etc.)* 5662
3120R *Valence bond calculations (ab initio or not)* 5662
3120T *Electron correlation and CI calculations* 5662
3120W *Empirical methods (nonquantum methods for conformations, as Wiberg method, Westheimer method, etc.)* —
3130 Corrections to electronic structure 5663
3150 Excited states 5663
3170 Effects of molecular interactions on electronic structure 5663
3170D *Environmental and solvent effects* 5663
3170F *Potential-energy surfaces for collisions* 5663
3170H *Time-dependent phenomena: excitation and relaxation processes, and reaction rates* 5663
3170K *Molecular solids* —
3190 Other topics in the theory of atoms and molecules 5663

3200 ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS 5664
3220 Atomic spectra grouped by wavelength ranges 5664
3220B *Radiofrequency, microwave, and infrared spectra* 5664
3220J *Visible and ultraviolet spectra* 5664
3220R *X-ray spectra* 5664
3250 Fluorescence, phosphorescence 5664
3260 Zeeman and Stark effects 5665
3270 Spectral line shapes and intensities 5665
3280 Photon interactions with atoms 5665
3280B *Level crossing and optical pumping* 5666
3280D *Autoionization* 5666
3280F *Photoionization and photodetachment* 5666
3280H *Auger effect and inner-shell ionization* 5666
3280K *Multiphoton processes* 5666
3290 Other topics in atomic spectra and interactions with photons —

3300 MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS 5666
3310 Calculation of molecular spectra 5666
3320 Molecular spectra grouped by wavelength ranges 5668
3320B *Radiofrequency and microwave spectra* 5668
3320E *Infrared spectra* 5668
3320F *Raman and Rayleigh spectra* 5670
3320K *Visible spectra* 5671
3320L *Ultraviolet spectra* 5671
3320N *Vacuum ultraviolet spectra* 5671
3320R *X-ray spectra* 5672
3325 Nuclear magnetic resonance and relaxation; nuclear quadrupole resonance (NQR) 5672
3330 Electron paramagnetic resonance and relaxation 5673
3335 Double resonances and other multiple resonances 5673
3335H *MODR and PMDR (microwave optical double resonance and phosphorescence microwave double resonance)* —
3340 Mössbauer spectra —
3345 Magneto-optical and electro-optical spectra; dichroism 5674
3345B *Zeeman and Stark effects* 5674
3345C *Magnetic circular dichroism* 5674
3350 Fluorescence, phosphorescence; radiationless transitions (intersystem crossing, internal conversion) 5674
3365 Photoelectron spectra 5675
3370 Intensities and shapes of molecular spectral lines and bands 5676
3380 Photon interactions with molecules 5676
3380B *Level crossing and optical pumping* 5676
3380E *Autoionization, photoionization, and photodetachment* 5677
3380G *Diffuse spectra; predissociation, photodissociation* 5677
3380K *Multiphoton processes* 5678
3390 Other topics in molecular spectra and interactions with photons —

3400 ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS 5678
3410 General theories and models 5678
3420 Interatomic and intermolecular potentials and forces 5678
3440 Elastic scattering of atoms and molecules 5679
3450 Inelastic scattering of atoms and molecules 5679
3450E *Rotational and vibrational energy transfer* 5679
3450H *Electronic excitation and ionization (inc. beam-foil excitation and ionization)* 5680
3450L *Chemical reactions, energy disposal, and angular distribution, as studied by atomic and molecular beams* 5680
3470 Charge transfer 5680
3480 Electron scattering 5681
3480B *Elastic scattering of electrons by atoms and molecules* 5681
3480D *Atomic excitation and ionization by electron impact* 5681
3480G *Molecular excitation, ionization, and dissociation by electron impact* 5682
3490 Other topics in atomic and molecular collision processes and interactions 5682

page
3500 PROPERTIES OF ATOMS AND MOLECULES; INSTRUMENTS AND TECHNIQUES 5682
3510 Atoms 5682
3510B *Atomic masses, mass spectra, abundances, and isotopes* 5682
3510D *Electric and magnetic moments, polarizability* 5682
3510F *Relativistic corrections, fine- and hyperfine-structure constants* 5682
3510H *Ionization potentials, electron affinities* 5683
3510W *Weak Interactions* —
3520 Molecules 5683
3520B *General molecular conformation and symmetry; stereochemistry* 5683
3520D *Interatomic distances and angles* 5683
3520G *Bond strengths, dissociation energies, hydrogen bonding, etc* 5683
3520J *Barrier heights (internal rotation, inversion); rotational isomerism, conformational dynamics* 5683
3520M *Electric and magnetic moments (and derivatives), polarizability, and magnetic susceptibility* 5684
3520P *Rotation, vibration, and vibration-rotation constants* 5684
3520S *Hyperfine and fine-structure constants* 5684
3520V *Ionization potentials, electron affinities, molecular core binding energy* 5684
3520W *Weak interactions* —
3520X *Mass spectra* 5684
3520Y *Correlation times in molecular dynamics* 5684
3580 Atomic and molecular measurements and techniques 5684

3600 STUDIES OF SPECIAL ATOMS AND MOLECULES 5684
3610 Exotic atoms and molecules (containing mesons, muons, and other abnormal particles) 5684
3620 Macromolecules and polymer molecules 5685
3640 Atomic and molecular clusters 5685
3690 Other special atoms and molecules 5685

4000 **CLASSICAL AREAS OF PHENOMENOLOGY** 5685

4100 ELECTRICITY AND MAGNETISM; FIELDS AND CHARGED PARTICLES 5685
4110 Classical electromagnetism 5685
4110D *Electrostatics, magnetostatics* 5685
4110F *Steady-state electromagnetic fields; electromagnetic induction* 5686
4110H *Electromagnetic waves: theory* 5686
4170 Particles in electromagnetic fields: classical aspects 5686
4180 Particle beams and particle optics 5686
4180D *Electron beams and electron optics* 5686
4180G *Ion beams and ion optics* —
4190 Other topics in electricity and magnetism —

4200 OPTICS 5686
4210 Propagation and transmission in homogeneous media 5686
4220 Propagation and transmission in inhomogeneous media 5687
4230 Optical information, image formation and analysis 5687
4240 Holography 5688
4250 Quantum optics 5688
4252 Masers 5689
4255 Lasing processes 5689
4255B *General theory of lasing action* 5689
4255D *CO_2 lasers* 5689
4255F *Inert gas lasers* 5689
4255H *Lasing action in other gas lasers* 5689
4255K *Chemical lasers* 5690
4255M *Lasing action in liquids and organic dyes* 5690
4255P *Lasing action in semiconductors with junctions* 5690
4255R *Lasing action in other solids* 5691
4255T *Free electron lasers* 5691
4260 Laser systems and laser beam applications 5691
4260B *Design of specific laser systems* 5692
4260D *Laser resonators and cavities* 5692
4260F *Laser beam modulation* 5692
4260H *Optical problems related to properties and interactions of laser beams* 5693
4260K *Optical problems related to applications of laser beams* 5694
4265 Nonlinear optics 5694
4265B *General theory* 5695
4265C *Stimulated Raman, Brillouin and Rayleigh scattering; parametric oscillations and harmonic generation* 5695
4265F *Phase conjugation* 5695
4265G *Photon echoes, self-induced transparency, optical saturation and related effects* 5696
4265J *Beam trapping, self focusing, thermal blooming, and related effects* 5697
4270 Optical materials 5697
4270C *Glass* 5697
4270G *Light-sensitive materials* 5697
4272 Optical sources and standards 5697
4278 Optical lens and mirror systems 5697
4278H *Coatings* 5698
4280 Optical devices, techniques and applications 5698

page
4280B *Spatial filters, zone plates* 5698
4280C *Spectral and other filters* 5698
4280D *Monochromators* 5698
4280E *Shutters, windows, diaphragms, deflectors, choppers* 5698
4280F *Gratings, echelles* 5698
4280K *Optical beam modulators* 5698
4280L *Optical waveguides* 5699
4280M *Fibre optics* 5699
4280Q *Image detectors, convertors, and intensifiers* 5700
4280S *Optical communications devices* 5700
4282 Integrated optics 5700
4285 Optical testing and workshop techniques 5701
4290 Other topics in optics —

4300 ACOUSTICS 5701
4320 General linear acoustics 5701
4325 Nonlinear acoustics and macrosonics 5702
4328 Aeroacoustics and atmospheric sound 5703
4330 Underwater sound 5703
4335 Ultrasonics, quantum acoustics, and physical effects of sound 5704
4340 Mechanical vibrations and shock 5704
4345 Statistical studies of acoustical response 5704
4350 Noise, its effects and control 5704
4355 Architectural acoustics 5705
4360 Acoustic signal processing 5705
4363 Acoustic holography —
4370 Speech communication 5705
4375 Music and musical instruments 5706
4385 Acoustical measurements and instrumentation 5706
4388 Transduction; devices for the generation and reproduction of sound 5707
4390 Other topics in acoustics —

4400 HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES 5707
4410 Heat conduction (models, phenomenological description) 5707
4425 Convective and constrained heat transfer 5707
4430 Heat transfer in inhomogeneous media and through interfaces 5707
4440 Radiative heat transfer 5708
4450 Thermal properties of matter (phenomenology, experimental techniques) 5708
4460 Thermodynamic processes (phenomenology, experimental techniques) 5708
4490 Other topics in heat flow, thermal and thermodynamic processes —

4600 MECHANICS, ELASTICITY, RHEOLOGY 5708
4610 Mechanics of discrete systems 5708
4620 Continuum mechanics 5708
4630 Mechanics of solids and rheology 5709
4630C *Static elasticity* 5709
4630J *Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation* 5711
4630L *Static buckling and instability* 5712
4630M *Vibrations, aeroelasticity, hydroelasticity, mechanical waves, and shocks* 5713
4630N *Fracture mechanics, fatigue, and cracks* 5716
4630P *Friction, wear, adherence, hardness, mechanical contacts* 5717
4630R *Measurement methods and techniques* 5718
4660 Rheology of fluids and pastes 5719
4690 Other topics in mechanics, elasticity, and rheology —

4700 FLUID DYNAMICS 5719
4710 General theory 5719
4715 Laminar flows 5719
4715C *Laminar boundary layers* 5719
4715F *Stability of laminar flows* 5720
4720 Hydrodynamic stability 5720
4725 Turbulent flows, convection, and heat transfer 5720
4725C *Isotropic turbulence* 5720
4725F *Boundary layer and shear turbulence* 5721
4725J *Turbulent diffusion* —
4725M *Noise (turbulence generated)* 5722
4725Q *Convection and heat transfer* 5722
4725R *Wakes* 5723
4730 Rotational flow and vorticity 5723
4735 Waves 5724
4740 Compressible flows; shock and detonation phenomena 5725
4740D *General subsonic flows* 5725
4740H *Transonic flows* 5725
4740K *Supersonic and hypersonic flows* 5725
4740N *Shock-wave interactions* 5726
4745 Rarefied gas dynamics 5726
4750 Non-Newtonian dynamics 5726
4755 Nonhomogeneous flows 5727
4755B *Cavitation* 5727
4755C *Jets* 5727
4755E *Nozzles* 5728
4755H *Stratified flows* 5728
4755K *Multiphase flows* 5728
4755M *Flow through porous media* 5729
4760 Flows in ducts, channels, and conduits 5729
4765 Magnetohydrodynamics and electrohydrodynamics 5730
4770 Reactive, radiative, or nonequilibrium flows 5731
4775 Relativistic fluid dynamics 5731
4780 Instrumentation for fluid dynamics 5731
4790 Other topics in fluid dynamics —

5000 FLUIDS, PLASMAS AND ELECTRIC DISCHARGES 5732

5100 KINETIC AND TRANSPORT THEORY OF FLUIDS; PHYSICAL PROPERTIES OF GASES 5732
5110 Kinetic and transport theory 5732
5120 Viscosity and diffusion: experimental 5732
5130 Thermal properties of gases 5732
5140 Acoustical properties of gases; ultrasonic relaxation —
5150 Electrical phenomena in gases 5732
5160 Magnetic phenomena in gases 5733
5170 Optical phenomena in gases 5733
5190 Other topics in the physics of fluids —

5200 THE PHYSICS OF PLASMAS AND ELECTRIC DISCHARGES 5733
5220 Elementary processes in plasma 5733
5220F *Electron collisions* 5733
5220H *Atomic, molecular, heavy-particle collisions* 5733
5225 Plasma basic properties 5733
5225F *Transport properties* 5733
5225P *Emission, absorption, and scattering of radiation* 5734
5230 Plasma flow; magnetohydrodynamics 5735
5235 Waves, oscillations, and instabilities in plasma 5735
5235R *Plasma turbulence* 5736
5235T *Shock waves* 5737
5240 Plasma interactions 5737
5240D *Electromagnetic wave propagation in plasma* 5737
5240F *Antennas in plasma; plasma-filled wave guides* 5737
5240H *Solid-plasma interactions* 5737
5240K *Sheaths* 5738
5240M *Beam interactions in plasma* 5738
5250 Plasma production and heating 5738
5250J *Plasma production and heating by laser beams* 5738
5250L *Plasma production and heating by shock wave and wire explosion* 5739
5255 Plasma equilibrium and confinement 5739
5260 Relativistic plasma 5741
5265 Plasma simulation 5741
5270 Plasma diagnostic techniques and instrumentation 5741
5275 Plasma devices and applications 5742
5280 Electric discharges 5742
5290 Other topics in plasma physics and electric discharges —

6000 CONDENSED MATTER: STRUCTURE, THERMAL AND MECHANICAL PROPERTIES 5744

6100 STRUCTURE OF LIQUIDS AND SOLIDS; CRYSTALLOGRAPHY 5744
6110 X-ray determination of structures 5744
6110D *Theories of diffraction and scattering* —
6110F *Experimental techniques* 5744
6112 Neutron determination of structures 5744
6114 Electron determination of structures 5745
6114D *Theories of diffraction and scattering* —
6114F *Experimental diffraction and scattering* 5745
6114H *Low-energy electron diffraction (LEED) and reflection High-energy electron diffraction (RHEED)* 5745
6116 Other determination of structures 5745
6116D *Electron microscopy determinations* 5745
6116F *Field-ion microscopy determinations* 5745
6116N *EPR and NMR determinations* 5745
6120 Classical, semiclassical, and quantum theories of liquid structure 5745
6125 Studies of specific liquid structures 5746
6125M *Liquid metals* 5747
6130 Liquid crystals 5747
6140 Amorphous and polymeric materials 5748
6140D *Glasses* 5748
6140K *Polymers, elastomers, and plastics* 5750
6150 Crystalline state 5750
6150C *Physics of crystal growth* 5750
6150E *Crystal symmetry; models and space groups, and crystalline systems and classes* 5751
6150J *Crystal morphology and orientation* 5751
6150K *Crystallographic aspects of polymorphic and order-disorder transformations* 5751
6150L *Crystal binding* 5751
6155 Specific structure of elements and alloys 5751
6155D *Nonmetallic elements* 5751
6155F *Metallic elements* 5751
6155H *Alloys* 5752
6160 Specific structure of inorganic compounds 5752
6165 Specific structure of organic compounds 5753
6170 Defects in crystals 5754

page
6170B *Interstitials and vacancies* 5754
6170D *Colour centres* 5754
6170E *Other point defects* —
6170G *Dislocations: theory* 5754
6170J *Etch pits, decoration, transmission electron-microscopy and other direct observations of dislocations* 5755
6170L *Slip, creep, internal friction and other indirect evidence of dislocations* 5755
6170N *Grain and twin boundaries* 5755
6170P *Stacking faults, stacking fault tetrahedra and other planar or extended defects* 5756
6170R *Crystal impurities: general* 5756
6170T *Doping and implantation of impurities* 5757
6170W *Impurity concentration, distribution, and gradients* 5758
6170Y *Interaction between different crystal structure defects* 5758
6180 Radiation damage and other irradiation effects 5758
6180B *Laser beams* 5758
6180C *X-rays* 5759
6180E *Gamma rays* 5759
6180F *Electrons and positrons* 5759
6180H *Neutrons* 5759
6180J *Ions* 5760
6180L *Atoms and molecules* —
6180M *Channelling, blocking and energy loss of particles* 5760
6190 Other topics in structure of liquids and solids —

6200 MECHANICAL AND ACOUSTIC PROPERTIES OF CONDENSED MATTER 5760
6210 Mechanical properties of liquids 5760
6220 Mechanical properties of solids (related to microscopic structure) 5760
6220D *Elastic constants* 5761
6220F *Deformation and plasticity* 5761
6220H *Creep* 5762
6220M *Fatigue, brittleness, fracture, and cracks* 5762
6220P *Tribology* 5763
6230 Mechanical and elastic waves 5764
6240 Anelasticity, internal friction, and damping 5764
6250 High-pressure and shock-wave effects in solids 5764
6260 Acoustic properties of liquids 5764
6265 Acoustic properties of solids 5764
6280 Ultrasonic relaxation —
6290 Other topics in mechanical and acoustical properties of condensed matter —

6300 LATTICE DYNAMICS AND CRYSTAL STATISTICS 5765
6310 General theory 5765
6320 Phonons and vibrations in crystal lattices 5765
6320D *Phonon states and bands, normal modes, and phonon dispersion* 5765
6320H *Phonon-phonon interactions* 5766
6320K *Phonon-electron interactions* 5766
6320M *Phonon-defect interactions* 5766
6320P *Localized modes* 5766
6350 Vibrational states in disordered systems 5766
6370 Statistical mechanics of lattice vibrations 5766
6375 Statistical mechanics of displacive phase-transitions 5766
6390 Other topics in lattice dynamics and crystal statistics 5766

6400 EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS 5766
6410 General theory of equations of state and phase equilibria 5766
6430 Equations of state of specific substances 5767
6460 General studies of phase transitions 5767
6470 Phase equilibria, phase transitions, and critical points 5767
6470D *Solid-liquid transitions* 5767
6470F *Liquid-vapour transitions* 5768
6470H *Solid-vapour transitions* 5768
6470J *Liquid-liquid transitions* 5769
6470K *Solid-solid transitions* 5769
6470M *Transitions in liquid crystals* 5769
6470P *Glass transitions* 5770
6475 Solubility, segregation, and mixing 5770
6480 Other phase properties of systems 5771
6490 Other topics in equations of state, phase equilibria, and phase transitions —

6500 THERMAL PROPERTIES OF CONDENSED MATTER 5772
6520 Heat capacities of liquids 5772
6540 Heat capacities of solids 5772
6550 Thermodynamic properties and entropy 5772
6570 Thermal expansion and thermomechanical effects 5773
6590 Other topics in thermal properties of condensed matter 5773

6600 TRANSPORT PROPERTIES OF CONDENSED MATTER (NONELECTRONIC) 5773
6610 Diffusion and ionic conduction in liquids 5773
6620 Diffusive momentum transport 5773
6630 Diffusion in solids 5774

page
6630D *Theory of diffusion and ionic conduction in solids* 5774
6630F *Self-diffusion in metals, semimetals, and alloys* 5774
6630H *Self-diffusion and ionic conduction in nonmetals* 5774
6630J *Diffusion, migration, and displacement of impurities* 5775
6630L *Diffusion, migration, and displacement of other defects* 5775
6630N *Chemical interdiffusion* 5775
6630Q *Electromigration* 5775
6660 Thermal conduction in nonmetallic liquids 5775
6670 Nonelectronic thermal conduction and heat-pulse propagation in nonmetallic solids 5776
6690 Other topics in nonelectronic transport properties —

6700 QUANTUM FLUIDS AND SOLIDS; LIQUID AND SOLID HELIUM 5776
6720 Quantum effects on the structure and dynamics of nondegenerate fluids —
6740 Boson degeneracy and superfluidity of helium-4 —
6750 Fermi fluids; liquid helium-3 5776
6760 Mixed systems; liquid helium 3-4 mixtures —
6770 Films —
6780 Solid helium and related quantum crystals 5776
6790 Other topics in quantum fluids and solids (e.g. neutron-star matter) 5776

6800 SURFACES AND INTERFACES; THIN FILMS AND WHISKERS 5776
6810 Fluid surfaces and interfaces with fluids 5776
6815 Liquid thin films 5777
6820 Solid surface structure 5777
6825 Mechanical and acoustical properties of solid surfaces and interfaces 5778
6830 Dynamics of solid surfaces and interface vibrations 5778
6840 Surface energy of solids; thermodynamic properties 5779
6845 Solid-fluid interface processes 5779
6848 Solid-solid interfaces 5782
6855 Thin film growth, structure, and epitaxy 5782
6860 Physical properties of thin films, nonelectronic 5784
6870 Whiskers and dendrites: growth, structure, and nonelectronic properties 5784
6890 Other topics in the structure and nonelectronic properties of surfaces and thin films 5784

7000 **CONDENSED MATTER: ELECTRONIC STRUCTURE, ELECTRICAL, MAGNETIC, AND OPTICAL PROPERTIES** 5785

7100 ELECTRON STATES 5785
7110 General theories and computational techniques 5785
7120 Electronic density of states determinations 5785
7125 Nonlocalized single-particle electronic states 5785
7125C *Techniques of band-structure calculation (general theory, applications of group theory, analytic continuation, etc)* 5785
7125H *Measurement of Fermi surface parameters* 5785
7125J *Effective mass and g-factors* 5785
7125L *Electron energy states in liquid metals* 5786
7125M *Electron energy states in amorphous and glassy solids* 5786
7125P *Band structure of crystalline metals* 5786
7125R *Band structure of crystalline elemental semiconductors* 5786
7125T *Band structure of crystalline semiconductor compounds and insulators* 5786
7130 Metal-insulator transitions 5787
7135 Excitons and related phenomena 5787
7136 Polaritons 5788
7138 Polarons and electron-phonon interactions 5789
7145 Collective effects 5789
7145G *Exchange, correlation, dielectric and magnetic functions, plasmons* 5789
7145J *Fermi-Thomas model* —
7145N *Calculations of total electronic binding energy* 5789
7150 Localized single-particle electronic states 5789
7155 Impurity and defect levels 5790
7155J *Localization in disordered structures* 5791
7165 Positron states 5791
7170 Level splitting and interactions 5791
7170C *Crystal and ligand fields* 5791
7170E *Spin-orbit coupling, Zeeman, Stark and strain splitting* 5791
7170G *Exchange interactions* 5792
7170J *Nuclear states and interactions* 5792
7190 Other topics in electron states —

7200 ELECTRONIC TRANSPORT IN CONDENSED MATTER 5792
7210 Theory of electronic transport; scattering mechanisms 5792
7215 Electronic conduction in metals and alloys 5792
7215C *Electrical and thermal conduction in amorphous and liquid metals and alloys* 5793
7215E *Electrical and thermal conduction in crystalline metals and alloys* 5793

page
7215G *Galvanomagnetic and other magnetotransport effects* 5793
7215H *Thermomagnetic effects* 5793
7215J *Thermoelectric effects* 5793
7215L *Relaxation times and mean free paths* 5793
7215N *Collective modes, e.g. in one-dimensional conductors* 5793
7215Q *Scattering mechanisms and Kondo effect* 5793
7220 Conductivity phenomena in semiconductors and insulators 5794
7220D *General theory, scattering mechanisms* 5794
7220F *Low-field transport and mobility; piezoresistance* 5794
7220H *High-field and nonlinear effects* 5795
7220J *Charge carriers: generation, recombination, lifetime, and trapping* 5796
7220M *Galvanomagnetic and other magnetotransport effects* 5797
7220N *Thermomagnetic effects* 5797
7220P *Thermoelectric effects* 5797
7230 High-frequency effects; plasma effects 5797
7240 Photoconduction and photovoltaic effects; photodielectric effects 5798
7250 Acoustoelectric effects 5799
7255 Magnetoacoustic effects 5799
7260 Mixed conductivity and conductivity transitions 5799
7270 Noise processes and phenomena 5799
7280 Conductivity of specific semiconductors and insulators 5799
7280C *Elemental semiconductors* 5799
7280E *III-V and II-VI semiconductors* 5800
7280G *Transition-metal compounds* 5800
7280J *Other crystalline inorganic semiconductors* 5800
7280L *Organic semiconductors* 5800
7280N *Amorphous and glassy semiconductors* 5800
7280P *Liquid semiconductors* 5800
7290 Other topics in electronic transport in condensed matter 5800

7300 ELECTRONIC STRUCTURE AND ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS 5800
7320 Electronic surface states 5800
7325 Surface conductivity 5801
7330 Surface double layers, Schottky barriers, and work functions 5801
7340 Interfaces 5802
7340B *Static electrification* 5802
7340G *Tunnelling: general* 5802
7340J *Metal-to-metal contacts* 5802
7340L *Semiconductor-to-semiconductor contacts, p-n junctions, and heterojunctions* 5802
7340M *Semiconductor-electrolyte contacts* 5803
7340N *Metal-nonmetal contacts* 5803
7340Q *Metal-insulator-semiconductor structures* 5804
7340R *Metal-insulator-metal structures* 5805
7340S *Metal-semiconductor-metal structures* 5805
7360 Electronic properties of thin films 5805
7360D *Metallic thin films* 5805
7360F *Semiconductor films* 5805
7360H *Insulating thin films* 5806
7360K *Superconducting films* 5806
7390 Other topics in electrical properties of surfaces, interfaces, and thin films —

7400 SUPERCONDUCTIVITY 5806
7410 Occurrence, critical temperature 5806
7420 Theory 5807
7420F *BCS theory and its applications* 5807
7430 General properties 5807
7430C *Magnetization curves, Meissner effect, penetration depth* 5807
7430E *Thermodynamic properties; thermal conductivity* 5807
7430G *Response to electromagnetic fields, nuclear magnetic resonance, ultrasonic attenuation* 5807
7440 Fluctuations and critical effects 5808
7450 Proximity effects, tunnelling phenomena, and Josephson effect 5808
7455 Type-I superconductivity 5808
7460 Type-II superconductivity 5808
7460E *Mixed state,* H_{c2}*, surface sheath* 5808
7460G *Flux pinning; fluxon-defect interactions* 5808
7460J *Critical currents* 5809
7470 Superconducting materials 5809
7470D *Material effects on* T_c*, K, critical currents* —
7470G *Type-I superconductors (non transition metals)* 5809
7470L *Type-II superconductors (transition metals, alloys and compounds)* 5809
7470N *Dirty superconductors* 5809
7470P *Materials for high-field applications* 5809
7490 Other topics in superconductivity 5809

7500 MAGNETIC PROPERTIES AND MATERIALS 5809
7510 General theory and models of magnetic ordering 5809
7510D *Crystal-field theory and spin Hamiltonians* —
7510H *Ising and other classical spin models* 5809

page
7510J *Heisenberg and other quantized localized spin models* 5810
7510L *Band and itinerant models* —
7520 Diamagnetism and paramagnetism 5810
7520C *Nonmetals* 5810
7520E *Metals and alloys* 5810
7520H *Local moment in dilute alloys; Kondo effect* 5810
7525 Spin arrangements in magnetically ordered materials (neutron studies, etc) 5810
7530 Magnetically ordered materials, other intrinsic properties 5811
7530C *Saturation moments and magnetic susceptibility* 5811
7530D *Spin waves* 5811
7530E *Exchange and superexchange interactions* 5811
7530G *Anisotropy* 5812
7530H *Magnetic impurity interactions* 5812
7530K *Magnetic phase boundaries* 5812
7530S *Magnetocaloric effect* 5813
7540 Critical-point effects, specific heats, short-range order 5813
7540D *Ising and other classical spin models* 5813
7540F *Heisenberg and other quantized spin models* 5814
7550 Studies of specific magnetic materials 5814
7550B *Ferromagnetism of Fe and its alloys* 5814
7550C *Ferromagnetism of other metals* 5814
7550D *Ferromagnetism of nonmetals* 5814
7550E *Antiferromagnetics* 5814
7550G *Ferrimagnetics* 5815
7550K *Amorphous magnetic materials* 5815
7550M *Magnetic liquids* —
7560 Domain effects, magnetization curves, and hysteresis 5815
7560C *Domain walls and domain structure* 5815
7560E *Magnetization curves, hysteresis, Barkhausen and related effects* 5815
7560G *High coercivity materials* 5816
7560J *Fine-particle systems* 5816
7560L *Magnetic aftereffects* 5816
7560N *Magnetic annealing and temperature-hysteresis effects* 5816
7570 Magnetic films and plates 5816
7570K *Domain structure (magnetic bubbles)* 5816
7580 Magnetomechanical and magnetoelectric effects, magnetostriction 5817
7590 Other topics in magnetic properties and materials 5817

7600 MAGNETIC RESONANCES AND RELAXATION IN CONDENSED MATTER; MÖSSBAUER EFFECT 5817
7620 General theory of resonances and relaxation 5817
7630 Electron paramagnetic resonance and relaxation 5817
7630D *Ions and impurities: general* 5817
7630F *Iron group (3d) ions and impurities (Ti-Cu)* 5817
7630H *Platinum and palladium group (4d and 5d) ions and impurities (Zr-Ag and Hf-Au)* —
7630K *Rare-earth ions and impurities* 5818
7630L *Other ions and impurities* 5818
7630M *Colour centres and other defects* 5818
7630P *Conduction electrons* 5818
7630R *Free radicals* 5818
7640 Diamagnetic and cyclotron resonances 5818
7650 Ferromagnetic, antiferromagnetic, and ferrimagnetic resonances; spin wave resonance 5819
7660 Nuclear magnetic resonance and relaxation 5819
7660C *Chemical and Knight shifts* 5820
7660E *Relaxation effects* 5820
7660G *Quadrupole resonance* 5820
7660L *Spin echoes* 5820
7670 Magnetic double resonances and cross effects 5820
7670D *Electron-nuclear double resonance (ENDOR)* —
7670E *Dynamical nuclear polarization* 5820
7670F *Double nuclear magnetic resonance (DNMR)* 5821
7670H *Optical double magnetic resonance (ODMR)* 5821
7670K *Electron double resonance (ELDOR)* —
7680 Mössbauer effect; other gamma-ray spectroscopy 5822
7690 Other topics in magnetic resonances and relaxation 5822

7700 DIELECTRIC PROPERTIES AND MATERIALS 5822
7720 Permittivity 5822
7730 Polarization and depolarization effects 5823
7740 Dielectric loss and relaxation 5823
7750 Dielectric breakdown and space-charge effects 5823
7755 Dielectric thin films 5823
7760 Piezoelectricity and electrostriction 5823
7770 Pyroelectric and electrocaloric effects 5823
7780 Ferroelectricity and antiferroelectricity 5824
7780B *Transitions and Curie point* 5824
7780D *Domain structure and effects; hysteresis* 5824
7785 Electrical resonances —
7790 Other topics in dielectric properties and materials —

7800 OPTICAL PROPERTIES AND CONDENSED MATTER SPECTROSCOPY AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION 5824
7820 Optical properties and materials 5824
7820B *General theory (for pure homogeneous materials)* 5824

		page
7820D	*Optical constants and parameters*	5824
7820E	*Optical rotatory power*	5825
7820F	*Birefringence*	5826
7820H	*Piezo-, elasto- and acousto-optical effects*	5826
7820J	*Electro-optical effects*	5826
7820L	*Magneto-optical effects*	5826
7820N	*Thermo-optical effects*	5827
7830	Infrared and Raman spectra and scattering	5827
7835	Brillouin and Rayleigh scattering	5830
7840	Visible and ultraviolet spectra	5830
7845	Stimulated emission	5831
7850	Impurity and defect absorption in solids	5831
7855	Photoluminescence	5832
7860	Other luminescence spectra and radiative recombination	5833
7860F	*Electroluminescence*	5833
7860H	*Cathodoluminescence, ionoluminescence*	5834
7860K	*Thermoluminescence*	5834
7860M	*Sonoluminescence, triboluminescence*	—
7860P	*Chemiluminescence*	—
7865	Optical properties of thin films	5834
7870	Other interactions of matter with particles and radiation	5835
7870B	*Positron annihilation*	5835
7870C	*X-ray scattering*	—
7870D	*X-ray absorption and absorption edges*	5835
7870E	*X-ray emission threshold and fluorescence*	5835
7870G	*Microwave and radiofrequency interactions*	—
7890	Other topics in optical properties of condensed matter and other interactions of matter with particles and radiation	—
7900	ELECTRON AND ION EMISSION BY LIQUIDS AND SOLIDS; IMPACT PHENOMENA	5835
7920	Impact phenomena	5835
7920D	*Laser-light impact phenomena*	5836
7920F	*Electron impact: Auger emission*	5836
7920H	*Electron impact: secondary emission*	5836
7920K	*Other electron impact phenomena*	5837
7920N	*Atom, molecule, and ion impact*	5837
7920R	*Atomic and molecular beam interactions*	5839
7940	Thermionic emission	5839
7960	Photoemission and photoelectron spectra	5839
7970	Field emission and field ionization	5842
7975	Exoelectron emission	5842
7980	Resonance tunnelling	—
7990	Other topics in emission and impact phenomena in condensed matter	—
8000	**CROSS-DISCIPLINARY PHYSICS AND RELATED AREAS OF SCIENCE AND TECHNOLOGY**	5842
8100	MATERIALS SCIENCE	5842
8110	Methods of crystal growth and purification	5842
8110B	*Growth from vapour*	5842
8110D	*Growth from solutions*	5842
8110F	*Growth from melts*	5843
8110H	*Zone melting and zone refining*	5843
8110J	*Growth from solid phases*	5843
8115	Methods of thin film deposition	5843
8115C	*Deposition by cathodic sputtering*	5843
8115G	*Vacuum deposition*	5844
8115H	*Chemical vapour deposition*	5844
8115J	*Ion plating and other vapour deposition*	5844
8115L	*Deposition from liquid phases (melts and solutions)*	5845
8120	Other methods of preparation of materials	5845
8120C	*Vacuum methods*	—
8120E	*Powder techniques, compaction and sintering*	5845
8120G	*Specific metals and alloys (compacts, pseudoalloys)*	5846
8120J	*Dispersion-fibre-, and platelet-reinforced metal-based composites*	5847
8120L	*Ceramics and refractories*	5847
8120N	*Cermets, ceramic and refractory composites*	5848
8120P	*Glasses*	5849
8120Q	*Glass-based composites, vitroceramics*	5849
8120S	*Polymers*	5849
8120T	*Reinforced polymers and polymer-based composites*	5849
8130	Phase diagrams and microstructures developed by solidification and solid-solid phase transformations	5849
8130B	*Phase diagrams of metals and alloys*	5850
8130D	*Phase diagrams of other materials*	5850
8130F	*Solidification*	5850
8130H	*Constant-composition solid-solid phase transformations: polymorphic, massive, and order-disorder*	5851
8130K	*Martensitic transformations*	5851
8130M	*Precipitation*	5851
8140	Treatment of materials and its effects on microstructures and properties	5852
8140C	*Solid solution hardening, precipitation hardening, dispersion hardening*	5852
8140E	*Cold working, work hardening; annealing, recovery and recrystallisation; textures*	5852
8140G	*Other heat and thermomechanical treatments*	5853
8140J	*Elasticity and anelasticity*	5854
8140L	*Deformation, plasticity and creep*	5855
8140N	*Fatigue, embrittlement, and fracture*	5858
8140P	*Friction, lubrication, and wear*	5862
8140R	*Electrical and magnetic properties (related to treatment conditions)*	5863
8140T	*Optical properties (related to treatment conditions)*	5863
8160	Corrosion, oxidation and surface treatments	5863
8160B	*Metals and alloys*	5864
8170	Materials testing	5867
8190	Other topics in materials science	—
8200	PHYSICAL CHEMISTRY	5869
8220	Chemical kinetics	5869
8220K	*Potential energy surfaces for chemical reactions*	5869
8220M	*Nonequilibrium kinetics*	—
8220R	*Energy distribution and transfer, relaxation*	5869
8230	Specific chemical reactions; reaction mechanisms	5869
8235	Polymer reactions and polymerization	5871
8240	Chemical kinetics and reactions: special regimes	5871
8240D	*Atomic and molecular beam reactions*	—
8240T	*Chemiluminescence and chemical laser kinetics*	5871
8245	Electrochemistry and electrophoresis	5871
8250	Photochemistry and radiation chemistry	5872
8250E	*Photodissociation, photoionization as studied by luminescence and radiationless transitions*	5872
8255	Radiochemistry	—
8260	Chemical thermodynamics	5873
8265	Surface processes	5873
8270	Disperse systems	5874
8280	Chemical analysis and related physical methods of analysis	5874
8290	Other topics in physical chemistry	—
8600	ENERGY RESEARCH AND ENVIRONMENTAL SCIENCE	5876
8610	Energy resources and their utilisation	5876
8610B	*Fossil and other fuels*	5876
8610D	*Wind energy*	5876
8610F	*Tidal and flow energy*	5876
8610H	*Geothermal energy*	5876
8610K	*Solar energy*	5877
8610N	*Nuclear energy*	—
8610Z	*Other topics*	5878
8630	Energy conversion	5878
8630D	*Electrochemical conversion: general*	—
8630E	*Primary cells*	5878
8630F	*Secondary cells*	5878
8630G	*Fuel cells*	5878
8630J	*Photoelectric conversion: solar cells and arrays*	5878
8630K	*Photoelectrochemical conversion*	5881
8630L	*Electrogasdynamic and magnetohydrodynamic conversion*	—
8630M	*Thermoelectric conversion*	—
8630N	*Thermionic conversion*	—
8630P	*Photosynthesis*	5881
8630Q	*Chemical energy conversion*	5881
8630R	*Thermal energy conversion (heat engines and heat pumps)*	5881
8630S	*Photothermal conversion*	5881
8630Z	*Other topics*	—
8640	Energy storage (secondary energy)	5882
8640C	*Storage in mechanical energy*	—
8640F	*Storage in thermal energy*	5882
8640H	*Storage in chemical energy*	5882
8640K	*Hydrogen storage and technology*	5882
8640Z	*Other topics*	—
8660	Requirement for energy: ecological aspects	—
8670	Environmental science	5883
8670C	*Soil*	5883
8670E	*Water*	5883
8670G	*Atmosphere*	5883
8670J	*Noise*	5883
8670L	*Measurement techniques in environmental science*	5884
8670Z	*Other topics*	5884
8690	Other topics in energy research and environmental science	—
8700	BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING	5884
8710	General, theoretical, and mathematical biophysics	5884
8715	Molecular biophysics	5884
8715B	*Structure, configuration, conformation, and active sites at the biomolecular level*	5885
8715M	*Interactions with radiations at the biomolecular level*	5886
8716	Biothermics	5886
8720	Membrane biophysics	5886
8725	Cellular biophysics	5887
8725D	*Biological transport; cellular and subcellular transmembrane physics*	5888
8730	Biophysics of neurophysiological processes	5888

		page
8732	Physiological optics, vision	5889
8732C	*Anatomy and optics of the eye*	5889
8732E	*Physiology of the eye; nerve structure and function*	5889
8732L	*Light detection; adaptation and discrimination*	5890
8732N	*Colour detection; adaptation and discrimination*	5890
8732S	*Psychophysics of vision, visual perception, binocular vision*	5890
8734	Audition	5890
8736	Speech	5892
8738	Mechano- and chemio-ceptions	5893
8740	Biomagnetism	5893
8745	Biomechanics, biorheology, biological fluid dynamics	5893
8750	Biological effects of radiations	5894
8750B	*Interactions of biosystems with radiations*	5894
8750C	*Bioacoustics (sonic and ultrasonic effects on living matter)*	—
8750E	*Bio-optics (effects of microwaves, light, laser and other electromagnetic waves)*	5895
8750G	*Ionizing radiations (u.v., X-ray, gamma-ray; particle radiation effects)*	5895
8760	Medical and biomedical uses of fields, radiations, and radioactivity	5896
8760B	*Sonic and ultrasonic radiation*	5896
8760D	*Electric and magnetic fields (d.c. and pulsed)*	5896
8760G	*Laser beams, microwaves, and other electromagnetic waves*	5896
8760J	*Corpuscular radiation and radioisotopes*	5897
8760L	*Preparation of radioactive materials for medical and biomedical uses*	5897
8760M	*Radiation dosimetry*	5897
8760P	*Radiation protection*	5897
8760R	*Radioactive pollution*	5897
8765	Aerospace biophysics and medical physics (effects of accelerations, weightlessness and environment)	5898
8770	Biomedical engineering	5898
8770E	*Diagnostic methods and instrumentation*	5898
8770G	*Patient care and treatment*	5898
8770J	*Prosthetics and other practical applications*	5899
8780	Biophysical instrumentation and techniques	5899
8790	Other topics in biophysics, medical physics, and biomedical engineering	5900
9000	**GEOPHYSICS, ASTRONOMY AND ASTROPHYSICS**	5900
9100	SOLID EARTH GEOPHYSICS	5900
9110	Geodesy and gravity	5900
9125	Geomagnetism and palaeomagnetism; geoelectricity	5901
9130	Seismology	5902
9135	Earth's interior structure and properties	5904
9140	Volcanology	5906
9145	Physics of plate tectonics	5906
9150	Marine geology and geophysics	5907
9160	Physical properties of rocks and minerals	5907
9165	Geophysical aspects of geology, mineralogy and petrology	5908
9190	Other topics in solid Earth geophysics	5908
9200	HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS	5909
9210	Physics of the oceans	5909
9220	Interdisciplinary aspects of oceanography	5912
9240	Hydrology and glaciology	5912
9260	Meteorology	5913
9260S	*Climatology*	5917
9265	Atmospheric optics	5917
9290	Other topics in hydrospheric and atmospheric geophysics	5918
9300	GEOPHYSICAL OBSERVATIONS, INSTRUMENTATION, AND TECHNIQUES	5918
9330	Information related to geographical regions	5918
9355	International organizations, national and international programs	—
9365	Data acquisition and storage	5919
9385	Instrumentation and techniques for geophysical research	5919
9400	AERONOMY AND SPACE PHYSICS	5922
9410	Physics of the neutral atmosphere	5922
9410Q	*Airglow and nightglow*	—
9410S	*Aurora*	—
9420	Physics of the ionosphere	5922
9430	Physics of the magnetosphere	5922
9440	Cosmic rays	5922
9440C	*Origin and propagation outside the solar system*	5922
9440E	*Interplanetary propagation and effects*	5922
9440H	*Energetic solar particles and photons*	5923
9440K	*Solar modulation and geophysical effects*	—
9440L	*Composition and energy spectra*	5923
9440N	*Extensive air showers*	5923
9440R	*High-energy interactions*	—
9440T	*Muons and neutrinos*	5923
9440V	*Cosmic-ray effects in meteorites and terrestrial matter*	—
9460	Interplanetary space	5923
9480	Aerospace facilities and techniques; space research	5923
9490	Other topics in space physics	—
9500	FUNDAMENTAL ASTRONOMY AND ASTROPHYSICS, INSTRUMENTATION AND TECHNIQUES AND ASTRONOMICAL OBSERVATIONS	5923
9510	Fundamental astronomy	5923
9510C	*Celestial mechanics*	5923
9530	Fundamental aspects of astrophysics	5924
9545	Observatories	—
9555	Astronomical instruments	5925
9565	Auxiliary and recording instruments	5925
9570	Other instrumentation and techniques	5925
9575	Techniques of observation and reduction	5925
9580	Astronomical observations (listed by techniques of observation)	5925
9580D	*Radio and radar*	5926
9580G	*Far infrared (bolometric, photoconductive)*	5926
9580J	*Photographic region (near infrared, visible, and normal ultraviolet)*	5926
9580M	*Space ultraviolet*	5926
9580N	*X-ray*	5926
9580Q	*gamma-ray and elementary particle*	—
9580S	*Other (inc. gravitational radiation, magnetograms, etc)*	—
9585	Catalogues, atlases etc	5926
9590	Other topics in astronomy and astrophysics	—
9600	SOLAR SYSTEM	5927
9610	General, solar nebula, and cosmogony	—
9620	Moon	5927
9630	Planets and satellites	5927
9630D	*Mercury*	—
9630E	*Venus*	5927
9630G	*Mars*	5927
9630H	*Asteroids*	5929
9630K	*Jupiter*	5929
9630M	*Saturn*	5929
9630T	*Other planets*	5929
9650	Other objects in the planetary system	5930
9650D	*Interplanetary matter, magnetic and electric fields*	—
9650G	*Comets*	5930
9650K	*Meteors, showers and meteoroids*	5930
9650M	*Meteorites, micrometeorites*	5931
9660	Solar physics	5931
9690	Other topics on the solar system	—
9700	STARS	5931
9710	Stellar characteristics	5931
9720	Normal stars (by class): general or individual	5932
9730	Variable and peculiar stars	5933
9760	Late stages of stellar evolution	5934
9760B	*Supernovae*	5934
9760G	*Pulsars*	5934
9760J	*Neutron stars*	5935
9760L	*Black holes*	5935
9780	Binary and multiple stars	5935
9790	Other topics in stellar astronomy	5936
9800	STELLAR SYSTEMS; GALACTIC AND EXTRAGALACTIC OBJECTS AND SYSTEMS; THE UNIVERSE	5936
9810	Stellar dynamics	5936
9820	Stellar clusters and associations	5936
9840	Interstellar matter; and nebulae	5936
9850	The Galaxy, extragalactic objects and systems	5938
9850K	*Groups, clusters, superclusters*	5939
9870	Other objects and background radiations of unknown origin and distances	5940
9870D	*Discrete radio sources*	5940
9870J	*Quasars*	5940
9870L	*IR sources*	5941
9870Q	*X-ray and gamma-ray sources*	5941
9870S	*Cosmic ray sources*	—
9870V	*Background radiations*	5941
9880	Cosmology	5941
9890	Other topics in galactic and extragalactic astronomy	—

AUTHOR INDEX xvii

followed by

SUBSIDIARY INDEXES

SUBJECT GUIDE

The SUBJECT GUIDE is an alphabetical index to subjects covered in the classification scheme, by which the abstracts are arranged. The numbers given are classification codes. The CLASSIFICATION AND CONTENTS, which precede the Guide, gives the page number for each section.

Classification
A mesons 1440
Ab initio calculations 3120
Aberrations 4180, 4230, 4278
Abrasion 4630P, 6220P, 8140P
Absorptive models 1240P
Acceleration measurement 0630G
Accumulation layers 7320, 7340Q
Acoustic devices 4385
Acoustic holography 4363
Acoustic noise 4350, 4360, 4388, 8670J
Acoustic nuclear magnetic resonance 7660
Acoustic paramagnetic resonance 7630
Acoustic properties of gases 5140
Acoustic properties of liquids 6260
Acoustic properties of solids 6265
Acoustic signal processing 4360
Acoustic wave propagation 4320, 4325, 5140, 6260, 6265
Acoustics 43
Acousto-optical effects 5140, 5170, 7820H
Acoustoelectric effects 4388, 5140, 5150, 7250
Adaptive optics 42
Adherence 4630P
Adhesion 4630P, 6825, 8190
Adsorption 6845, 8265
Aerodynamics 4740
Aeroelasticity 4630C, 4630M
Aeronomy 94
Aerosols 4755K, 8270, 92
Aerospace 9480, 9555
Aerospace biophysics 8765
Ageing 8140G
Airglow 9410Q
Algebra 0210
Alpha decay 2360
Alpha particle-nucleus reactions 2560
Alpha particle-nucleus scattering 2560
Alpha particle spectroscopy 2930
Alpha particles 2140, 2710
Amorphous semiconductors 6140, 7125M, 7220, 7280N
Amorphous state 6140, 81
Anderson model 7110, 7125M, 7155
Anelasticity 4630J, 6240, 8140J
Anemometers 4780, 9385
Angular measurement 0630C
Annealing 8140E, 8140G
Anodisation 8160, 8245
Antiferrimagnetism 7530
Antiferroelectric materials 7780
Antiferromagnetic properties of substances 75, 7550E
Antiferromagnetic resonance 7650
Antiphase boundaries 81
Antiphase domains 81
Antireflection coatings 4270, 4278H, 4280
Appearance potential spectroscopy 0785, 7870E
APW calculations 7110, 7125C
Architectural acoustics 4355
Artificial limbs 8770J
Artificial organs 8770J
Association 6120, 6125, 8230
Asteroids 9630H
Astroarchaeology 9590
Astrometry 95, 9555
Astronomical instruments 95
Astronomy and astrophysics 95, 96, 97, 98
Atlases 9585
Atmospheric acoustics 4328
Atmospheric optics 9265
Atmospherics 9260, 94
Atom beam reactions 8240D
Atom-surface impact 34, 7920N, 7920R
Atomic beams 3440, 3450, 3580, 8240D
Atomic clusters 3640
Atomic collisions 34
Atomic electric moments 3510D
Atomic electron correlations 3120T
Atomic electron impact excitation 3480
Atomic electron impact ionization 3480
Atomic excited states 3150
Atomic fine structure 3510F
Atomic fluorescence 3250
Atomic forces 3420
Atomic hyperfine interactions 3130
Atomic hyperfine structure 3510F
Atomic inelastic collisions 3450
Atomic magnetic moments 3510D
Atomic mass 3510B
Atomic orbital calculations 3120
Atomic orbitals 3120
Atomic phosphorescence 3250
Atomic physics 30

Classification
Atomic polarisability 3510D
Atomic spectra 32
Atomic structure 31, 3510
Atomic transitions 3110
Atoms 30
Audition 8734
Auger effect 3280H, 7920F, 7920N, 7960, 8260
Aurora 9410S
Autoionisation 3280D, 3380E
Axial vector currents 1140
Axiomatic field theory 1110

B mesons 1440
Background radiation 9870V
Band model of magnetism 7510L
Band structure 7125
Barkhausen effect 7560E
Barrier heights 3520J
Baryon-baryon interactions 1375C, 1375E, 1385
Baryon-baryon scattering 1375C, 1375E, 1385
Baryon decays 1330
Baryon electric moment 1340F, 1420
Baryon-kaon interactions 1375J, 1385
Baryon-kaon scattering 1375J, 1385
Baryon magnetic moment 1340F, 1420
Baryon mass 1420
Baryon parity 1420
Baryon-pion interactions 1375G, 1385
Baryon-pion scattering 1375G, 1385
Baryon production 1360P, 1365, 1375, 1385
Baryon resonance production 1360P, 1365, 1375, 1385
Baryon resonances 1420
Baryon spin 1420
Baryons 1420
BCS theory 2160, 7420F
Beam-foil excitation 3450H
Beam-foil ionisation 3450H
Beam handling equipment 2925
Beam handling techniques 2925
Bending 4630J, 6220F, 8140L
Beta decay 2340
Beta ray spectroscopy 2930
Betatrons 2920
Bethe-Salpeter equations 1110
Bi-metric gravity theories 0450
Bibliographies 0130T
Binary stars 9780
Binding energy 31, 3520V, 6150L
Bio-optics 8750E, 8760G
Bioacoustics 8738, 8750B, 8750C, 8760B
Biocommunications 87
Biocontrol 8710
Biocybernetics 8710
Bioelectric phenomena 8730, 8732E
Bioenergy conversion 8630Z
Biography 0150
Biological effects of radiation 8750
Biological fluid dynamics 8745
Biological techniques and instruments 8780
Biology 87
Biomagnetism 8740, 8760D
Biomass 8630Z
Biomechanics 8745
Biomedical engineering 8770
Biomedical equipment 8770
Biomedical measurement 8770
Biomedical ultrasonics 8760G
Biomedical uses of radiation and radioactivity 8760
Biomembrane transport 8720, 8725D
Biomembranes 8720
Biomolecular effects of radiation 8715M, 8750
Biomolecular structure 3620, 8715B
Biophysical techniques and instruments 8780
Biophysics 87
Biorheology 8745
Biothermics 8716
Biotransport 8725D, 8745
Birefringence 4210, 4220, 7820F
Black holes 9760L
Blood 87
Bolometers 0720, 0762
Boltzmann equation 0560
Bond angles 3520D
Bond lengths 3520D
Bond strength 3520G
Bonds (chemical) 31, 3520G, 6150L
Bone 87
Bootstrapping 1150, 1240F
Bose-Einstein statistics 0530

Classification
Boson systems 0530
Boundary layer flow 4715C, 4725F
Boundary layer turbulence 4725F
Brain 87
Bremsstrahlung 0350, 41, 7870
Brillouin spectra 3320F, 4265C, 5170, 7835
Brillouin zones 6320, 7125
Brink model 2160G
Brittleness 4630N, 6220M, 8140N
Brownian motion 0540
Bubble chambers 2940
Buckling 4630L, 6220F, 8140L

C invariance 1130
Calibration 0620H
Calorimetry 0720F
Cameras 0768
Capillarity 6810
Carbon dioxide lasers 4255D, 4260
Cardiology 87
Carrier density 7220
Carrier lifetime 7220J
Carrier mobility 7220
Casting 8120, 8130F
Catalogues 9585
Cathodochromism 7820
Cathodoluminescence 7860H
Cavitation 4755B
Celestial mechanics 0320, 9510C
Cells (electric) 8630D
Cellular biophysics 8725
Ceramic preparation 8120L, 8120N
Ceramics 81
Cermets 81
CESR 7630P
Chalcogenide glasses 6140D, 7280N
Channel flow 4760
Channelling 6180M
Chaos 0540
Charge density waves 7145, 7215N
Charge exchange 3470
Charge ordered states 7145, 7150
Charge transfer 3470
Charge transfer reactions 8230
Charge transfer states 31, 7170C
Charm particles 1420, 1440
Chemical analysis 8280
Chemical binding 3110, 3520G
Chemical energy conversion 8630Q
Chemical energy storage 8640H
Chemical kinetics 8220
Chemical lasers 4255K, 4260, 8240
Chemical reactions 3450L, 8230, 8235, 8240
Chemical shifts 3325, 7660C
Chemical thermodynamics 8260
Chemical vapour deposition 6855, 8115H
Chemiluminescence 5170, 7860P, 8240
Chemioception 8738
Chemisorption 6845, 8265
Cherenkov detectors 2940
Cherenkov radiation 41
Chiral symmetries 1130
Cholesteric liquid crystals 6130, 6470M
CI calculations 3120T
CIDEP 3330
CIDNP 3325
Cinematography 0768
Claddings 8160
Classical field theory 0350
Classical mechanics 0320, 0340
Classical statistical mechanics 0520
Clebsch-Gordon coefficients 0365
Climatology 9260
Cloud chambers 2940
Clouds 9260
Cluster approximation 7110, 7125M
CNDO calculations 3120N
CO_2 lasers 4255D, 4260
Coal 8610B
Coating techniques 6855, 8115, 8160
Coatings 6855, 8115, 8160
Coercivity 7560, 7780
Coherent antiStokes Raman scattering 3320F, 4265C, 7830
Cold working 8140E
Collective accelerators 2915
Colloids 4755K, 8270
Colorimetry 0760D
Colour centre lasers 4255R, 4260, 6170D
Colour centres 6170D, 7155, 7630M, 7850
Colour model 1235C
Colour vision 8732N
Comets 9650G

Classification
Commensurate-incommensurate transformations 0570, 6460, 6470K, 7780B
Compaction 8120E
Complex angular momentum plane 1160
Composite material preparation 8120J, 8120N, 8120Q, 8120T
Composite materials 81
Composite particle models 1235
Compressibility 4630J, 51, 6210, 6220F, 8140L
Compressible flow 4740
Compton effect 1360F, 6180C, 6180E, 7870
Computerised tomography 8760J, 8770E
Configuration interactions 3120T
Conformational dynamics 3520J
Conservation laws 1130
Constrained heat transfer 4425
Contact lenses 8732, 8770J
Continuous media mechanics 4620, 4630
Convection 0560, 4425, 4725Q, 5130
Conversion electron spectra 2320N
Correlation times 3520Y
Corrosion 8160, 8160B
Corrosion protective coatings 8160, 8160B
Corrosion testing 8170
Cosmic dust 9840
Cosmic ray interactions 1385M, 9440
Cosmic ray-nucleus reactions 2590, 9440R
Cosmic rays 9440, 9870S
Cosmogony 9610
Cosmology 9880
Cottrell atmospheres 6170G, 6170J, 6170L
Couette flow 4730
Coupled channel theory 2410
CP invariance 1130
CPA calculations 6350, 7110, 7125
CPT invariance 1130
Crack detection 8170
Cracks 4630N, 6220M, 8140N
Crazing 6220M, 8140N, 8160
Creep 4630J, 6170L, 6220H, 8140L
Creep testing 8170
Critical points 0570, 6460, 6470, 8260
Crossing symmetries 1150
Cryogenics 0720M
Crystal binding 6150L
Crystal defects 6170
Crystal field theory 7170C, 7510D
Crystal growth 6150C, 8110
Crystal growth from melt 6150C, 8110F
Crystal growth from solution 6150C, 8110D
Crystal growth from vapour 6150C, 8110B
Crystal hyperfine field interactions 7170, 7510D
Crystal inclusions 6170, 8130, 8140
Crystal microstructure 6170, 6480, 8130, 8140
Crystal morphology 6150J
Crystal purification 8110
Crystal structure 61
Crystal structure of alloys 6155H
Crystal structure of elements 6155D, 6155F
Crystal structure of inorganic compounds 6160
Crystal structure of organic compounds 6165
Crystal surface and interface vibrations 6830
Crystal symmetry 6150E
Crystallisation 6140, 6150C, 6470D
Crystallographic shear 6170P
Crystallography 61
Curie temperature 7530K, 7540, 7780B
Current algebra 1140
CVD coatings 6855, 8115H, 8160
Cyclic accelerators 2920
Cyclotron resonance 7125, 7640
Cyclotrons 2920

D mesons 1440
De Haas-van Alphen effect 7125
Debye temperature 6370
Debye-Waller factors 6370
Decomposition 6475, 8130
Deep levels 7155
Defect electron energy states 7155
Defibrillators 8770G, 8770J
Deformation 0340, 4630, 6220F, 8140L
Degenerate semiconductors 7220, 7280
Dendrites 6870
Dendritic structure 8130, 8140
Densitometry 0768
Density measurement 0630E
Density of liquids 6210
Density of solids 6220, 8190
Desorption 6845, 8265
Detonation 4740, 8240
Deuteron-nucleon interactions 1375C, 1385
Deuteron-nucleon scattering 1375C, 1385
Deuteron-nucleus reactions 2550
Deuteron-nucleus scattering 2550
Deuterons 2140, 2710
Diamagnetic properties of substances 5160, 7520
Dibaryons 1420
Dichroism 3345, 7820F

Classification
Dictionaries 0130K
Dielectric function 7145G, 7820D
Dielectric hysteresis 7780D
Dielectric losses 7740
Dielectric measurement 0750
Dielectric polarisation 5150, 7730
Dielectric properties of substances 77
Dielectric relaxation 5150, 7740
Dielectric resonance 7785
Dielectric thin films 7755
Differential geometry 0240
Diffraction gratings 4280F
Diffraction models 1240S
Diffuse spectra 3380G
Diffusion 0560
Diffusion in gases 5110, 5120
Diffusion in liquids 6610
Diffusion in solids 6630
DIM method 3120G
Dingle temperature 7125, 7520
Diode lasers 4255P, 4260
Dirac equation 0365
Direct nuclear reactions 2450
Discharges (electric) 5280
Disclinations 6130, 6170G, 6170J, 6170L
Discrete system mechanics 4610
Dislocations 6170G, 6170J, 6170L
Disperse systems 8270
Dispersion hardening 8140C
Dispersion relations 0210, 1120, 1150
Displacive transformations 6375, 6470K, 7780B
Dissociation 3380G, 3480G, 8230
Dissociation energies 3520G
Distorted wave Born approximations 2410
Distributed Bragg reflector lasers 4260, 4282
Distributed feedback lasers 4260, 4282
Domains 8130, 8140
Doping profiles 6170W
Dosimeters 2940, 2970
Dosimetry 2880, 8760M
Double NMR 3335, 7670F
Double resonances 3335, 7670
Drawing (mechanical) 6220F, 8120, 8140L
Drift chambers 2940
Dual models 1240H
Duct flow 4760
Ductility 4630J, 6220F, 8140L
Dye lasers 4255M, 4260
Dynamic nuclear polarisation 3335, 7670E
Dynamic testing 8170
Dynamical symmetries 1130
Dynamics 0320

Ear 8734
Earth 90
Earthquakes 9130
ECG 8730, 8770
Echelles 4280F
Eclipses 95, 9620, 9660
Ecology 8660
Education 0140, 0150
Educational aids 0150
Educational computer use 0150
EEG 8730, 8770
Eikonal models 1240P
Einstein equation 0420
Einstein-Maxwell fields 0440, 0450
Elastic constants 6220D
Elastic deformation 4630C, 6220F, 8140J
Elastic waves 0340K, 4630M, 6230
Elasticity 0340D, 4630C, 6220, 8140J
Elastomers 3620, 6140K, 81
ELDOR 3335, 7670K
Election correlations 3120T
Electrets 7730
Electric breakdown 5280, 7750
Electric charge 4110D
Electric discharges 5280
Electric domains 7780D
Electric fields 4110
Electric moments 2110K
Electrical conductivity of gases 5150
Electrical conductivity of liquids 6610, 72
Electrical conductivity of solids 72
Electrical conductivity transitions 7260
Electrical phenomena in gases 5150
Electrical properties of substances 5150, 72, 8140R
Electrical variables measurement 0750
Electricity 41
Electro-optical effects 3345, 5170, 7820J
Electrocardiography 8730, 8770
Electrochemical analysis 8280
Electrochemical energy conversion 8630D
Electrochemistry 8245
Electrodeposition 6855, 8115L, 8160, 8245
Electrodynamics 0350, 4170
Electroencephalography 8730, 8770
Electroforming 8120, 8245
Electrogasdynamic conversion 8630L
Electrohydrodynamics 4765

Classification
Electrojet 94
Electroluminescence 7860F
Electrolysis 8245, 8630D
Electrolytic polishing 8160, 8170
Electromagnetic corrections 1340H
Electromagnetic decays 1340H
Electromagnetic fields 4110
Electromagnetic induction 4110F
Electromagnetic interaction models 1220
Electromagnetic wave propagation 4110H
Electromagnetic waves in plasma 5240D
Electromagnetism 0350, 4110
Electromigration 6610, 6630Q
Electron affinity 3510H, 3520V
Electron beam deposition 8115G
Electron beam effects 51, 6180F
Electron beams 4180D
Electron capture decay 2340
Electron diffraction crystallography 6114
Electron-electron interactions 1310, 1365
Electron-electron scattering 1310
Electron emission 79
Electron energy states (condensed matter) 71
Electron field emission 7970
Electron gas 0530, 7145
Electron-hadron interactions 1360
Electron-hadron scattering 1360F
Electron-hole drops 7135, 7855
Electron-hole recombination 7220J
Electron impact 3480, 7920
Electron lenses 4180D
Electron microscopes 0780
Electron microscopy 0780, 6116D
Electron-nucleus reactions 2530
Electron-nucleus scattering 2530
Electron optics 4180D
Electron-phonon interactions 6320K, 7138, 72, 7420
Electron-positron interactions 1310, 1365
Electron-positron scattering 1310
Electron probe analysis 8280
Electron radiation 41
Electron ring accelerators 2915
Electron scattering 3480
Electron sources 2925
Electron spectra 3365, 3480, 79
Electron spectroscopy 0780, 2930, 3365, 79, 8280
Electron spin polarisation 75
Electron traps 7155, 7220J
Electronic conduction in thin films 7360
Electronic density of states 7120
Electronic excitation 3450H
Electronic ionisation 3450H
Electrons 1460
Electrophoresis 8245
Electrophoretic coatings 6855, 8115L, 8160
Electrophysiology 8730, 8732E
Electroplating 8115L, 8160
Electropolishing 8160, 8170
Electrostatic accelerators 2915
Electrostatic coatings 8115, 8160
Electrostatic lenses 4180
Electrostatics 4110D
Electrostriction 7760
Electroviscous effect 6210, 6620, 8270
Elemental abundance 3510B
Elemental semiconductors 7220, 7280C
Elementary particle electric moments 1340F
Elementary particle form factors 1340F
Elementary particle inclusive interactions 1310, 1360H, 1365, 1385K
Elementary particle magnetic moments 1340F
Elementary particle polarisation 1388
Elementary particle symmetries 1130
Ellipsometry 0760F
Embrittlement 6220M, 8140N
Emissivity 6590
ENDOR 3335, 7670D
Energy conversion 8630
Energy gap 7125, 74
Energy loss of particles 2970, 6180M
Energy range relationships 2970
Energy research 86
Energy resources 8610
Energy storage 8640
Enthalpy 0570, 6550, 8260
Entropy 0570, 5130, 6550
Epitaxial growth 6855, 8115
Epitaxial layers 6855, 6860
EPR 3330, 7630
Equations of state 0570, 5110, 6410, 6430
Eta meson resonances 1440
Eta mesons 1440
Etching 6170J, 8160, 8170
Euclidean field theory 1110
Eutectic structure 8130, 8140
Evaporation 6470F
Evolution (biological) 8790
EXAFS 3220R, 3320R, 7870D
Exchange interactions (electron) 7170G, 7530E
Excimer lasers 4255F, 4255H, 4260

Classification
Excitons 7135
Exoelectron emission 7975
Exosphere 94
Exotic atoms 3610
Exotic molecules 3610
Explosions 4740, 4770, 8240
Extraterrestrial life 8790, 9590
Eye 8732
Eye anatomy and optics 8732C
Eye physiology 8732E

F mesons 1440
Faddeev equation 1180
Fallout 2870, 2880, 9260, 94
Faraday effect 7820L
Fatigue 4630N, 6220M, 8140N
Fatigue testing 8170
Fermi-Dirac statistics 0530
Fermi level 7125
Fermi surface 7125H
Fermion systems 0530
Ferrimagnetic properties of substances 75, 7550G
Ferrimagnetic resonance 7650
Ferrites 7550G
Ferroacoustic resonance 7125, 7255, 7580
Ferroelectric semiconductors 7220, 7780
Ferroelectricity 7780
Ferromagnetic properties of substances 75, 7550B, 7550C, 7550D
Ferromagnetic resonance 7650
Few nucleon systems 2140
Fibre optics 4280M
Fibre reinforced composites 81
Field emission electron microscopy 0780, 6116D
Field emission ion microscopy 0780, 6116F
Field ion emission 7970
Filtration 4755M
Fission breeder reactors 2850
Fission counters 2940
Fission-fusion reactor systems 2858
Fission power reactors 2850
Fission reactor design 2841
Fission reactor fuel 2842
Fission reactor fuel preparation 2842H
Fission reactor fuel reprocessing 2842H
Fission reactor materials 2842
Fission reactor operation 2843
Fission reactor safety 2844
Fission reactor theory 2841
Fission reactor waste 2842
Fission research reactors 2850
Flames 8240
Flexoelectricity 6130, 7760
Flow 47
Flow birefringence 5170, 7820F
Flow instrumentation 4780
Flow measurement 4780
Flow separation 4755
Flow stability 4720
Flow through porous media 4755M
Flowmeters 4780
Fluctuations 0540
Fluid dynamics 0340G, 47
Fluid kinetic theory 5110
Fluid mechanics 0340G, 47
Fluid rheology 4660
Fluid transport theory 5110
Fluorescence 3250, 3350, 7855
Fluxmeters 0755
Foams 8270
Folding models 2410H
Forming processes 8120
Fossil fuels 8610B
Fourier transform optics 4230
Fracture 4630N, 6220M, 8140N
Fracture toughness testing 8170
Fragmentation reactions 2450
Free-electron approximation 7110, 7125C
Free electron lasers 4255T, 4260
Free energy 0570, 5130, 64, 6550
Free molecular flows 4745
Free radicals 30, 7630R, 8230, 8250
Frenkel defects 6170B
Friction 4630P, 6220P, 8140P
Fuel cells 8630G
Functional analysis 0230
Functions 0230
Fusion reactions 2588
Fusion reactor plasma confinement 5255
Fusion reactors 2852

Galaxies 9850
Galaxy 9850
Galvanomagnetic effects 7215G, 7220M
Gamma ray angular distributions 2320
Gamma ray astronomy 95
Gamma-ray effects 5170, 6180E
Gamma-ray lasers 4255
Gamma ray mixing ratios 2320

Classification
Gamma-ray sources 2925
Gamma-ray sources (astronomical) 9870Q
Gamma-ray spectra 2320, 7680
Gamma-ray spectroscopy 2930
Gamma ray transitions 2320
Garnets 7550G
Gas lasers 4255D, 4255F, 4255H, 4260
Gases 50
Gauge field theory 1110
Gegenschein 9650D
Geiger counters 2940
Gels 8270
General relativity 0420
Generalised Huckel calculations 3120P
Generator coordinate method 2160E
Geodesy 9110
Geoelectricity 9125
Geographical regions 9330
Geology 9165
Geometrical optics 42
Geometry 0240
Geophysical equipment 9385
Geophysics 91, 92, 93
Geothermal energy 8610H
Giant stars 9720
Ginzburg-Landau theory 7420
Glaciology 9240
Glass 4270C, 6140D, 81
Glass preparation 8120P, 8120Q
Glass transitions 6470P
Glauber model 2410H
Glauber scattering 1180
Gluons 1480
GO calculations 3120
Graded Lie algebras 1130
Grain boundaries 6170N, 8130, 8140
Grain size 8130, 8140
Granular structure 81
Graph theory 0210
Gravimeters 9385
Gravitation 04, 9530
Gravitational collapse 0440, 9530, 9760
Gravitational constants 0490
Gravitational experiments 0480
Gravitational interaction models 1225
Gravitational radiation 0430, 0480
Gravitational waves 0430, 0480
Gravity 0320, 9110
Grinding 4285, 8120, 8160
Group theory 0220, 0365, 1130
Guided electromagnetic wave propagation 0320, 4110H
Guided light propagation 4280L
Gunn effect 7220H

H I regions 9840
H II regions 9840
Hadron calorimeters 2970
Hadron classification schemes 1240K
Hadron-electron interactions 1360
Hadron-electron scattering 1360F
Hadron-hadron interactions 1375, 1385
Hadron-hadron scattering 1375, 1385
Hadron-muon interactions 1360
Hadron-muon scattering 1360F
Hadron-nucleus reactions 2540, 2580
Hadron-nucleus scattering 2540, 2580
Hadron-photon interactions 1360
Hadron-photon scattering 1360F
Hadronic decays 1325, 1330
Haemodynamics 8745
Half lives 23
Hall effect 7215G, 7220M
Hardening 8140C, 8140E, 8160
Hardness 4630P, 6220M, 6825, 8140N
Hardness testing 8170
Harmonic generation 4265C, 4325, 4360
Harmonic oscillators 0365
Hartree-Fock approximation 2160J, 3120D, 3120G, 7110
Hawking effects 0460
Health hazards 8750, 8760R, 8790
Health physics 8760
Hearing 8734
Hearing aids 8734, 8770J
Heat capacity 4450
Heat conduction 4410
Heat engines 8630R
Heat exchanges 8630R
Heat flow 44
Heat pumps 8630R
Heat radiation 4440
Heat transfer 44, 4725Q
Heat treatment 8140G
Heavily doped semiconductors 7220, 7280
Heavy ion-nucleus reactions 2570
Heavy ion-nucleus scattering 2570
Heavy leptons 1460
Heavy particle spectroscopy 2930
Heisenberg model 7510J, 7540F
Helicity 1130
Helicons 7230

Classification
Helium 3-nucleus reactions 2560
Helium 3-nucleus scattering 2560
Higgs bosons 1480
High-energy cosmic ray interactions 1385M, 9440
High field effects 7220H
High-frequency effects 7230
High pressure effects in solids 6250
High pressure techniques 0735
High temperature techniques 0720K
History 0160, 0165
Hodoscopes 2970
Hole traps 7155, 7220J
Holography 4240
Hopping conduction 7220F
Hot carriers 7220H, 7230
Hot working 8140G
Hubbard model 7110, 7510L
Huckel calculations 3120P
Humidity 51, 9260
Hybrid reactors 2858
Hydroelasticity 4630C, 4630M
Hydroelectric power 8610F
Hydrogen bonds 3520G
Hydrogen economy 8640K
Hydrogen embrittlement 6220M, 8140N, 8160
Hydrogen power 8640K
Hydrogen production 8640K
Hydrogen storage 8640K
Hydrology 9240
Hydrosphere 92
Hygrometry 0725
Hypernuclei 2180
Hyperon decays 1330
Hyperon-kaon interactions 1375J, 1385
Hyperon-kaon scattering 1375J, 1385
Hyperon-nucleon interactions 1375E, 1385
Hyperon-nucleon scattering 1375E, 1385
Hyperon-nucleus reactions 2580
Hyperon-nucleus scattering 2580
Hyperon-pion interactions 1375G, 1385
Hyperon-pion scattering 1375G, 1385
Hyperon resonances 1420
Hyperons 1420
Hypersonic flows 4740K
Hypothetical particles 1480

II-VI semiconductors 7220, 7280E
III-V semiconductors 7220, 7280E
III-VI semiconductors 7220, 7280
Image convertors, detectors & intensifiers 4280Q
Image processing 4230, 9575
Impact ionisation 7220H
Impurities 6170R, 6170T, 6170W
Impurity and defect absorption spectra of solids 7850
Impurity electron states 7155
Inclusions 6170, 8130, 8140
Indeterminancy 0365
INDO calculations 3120N
INDOR 3335
Inert gas lasers 4255F, 4260
Infrared astronomy 95
Infrared detectors 0730, 0762
Infrared imaging 0720, 4280Q, 8760G
Infrared sources (astronomical) 9870L
Infrared spectra 3220B, 3320E, 7830
Injection lasers 4255P, 4260
Injector acceleration 2910
Inner-shell ionisation 3280H
Instrumentation 06, 07
Insulating thin films 7360H
Integral radiation detectors 2970
Integrated optics 4282
Interacting boson model 2160E, 2160F
Interatomic angles 3520D
Interatomic distances 3520D
Interatomic forces 3420
Interatomic potentials 3420
Interface phenomena 68, 7340
Interferometry 0760L, 9575
Intergalactic matter 9850
Intermediate boson decay 1390
Intermediate bosons 1230, 1480
Intermediate state 7455
Intermolecular forces 3420
Intermolecular mechanics 3420
Intermolecular potentials 3420
Internal conversion 3250
Internal friction 6170L, 6240, 8140J
Internal rotation 3520J
Internal stresses 4630, 6220, 8140
Internal symmetries 1130
Interplanetary matter 9460, 9650D
Interstellar matter 9840
Interstitials 6170B
Inversion 3520J
Inversion layers 7320, 7340Q
Ion-atom collisions 34
Ion beam effects 6180J
Ion beams 4180G

Classification
Ion emission 79
Ion implantation 6170T, 6180J
Ion lasers 4255F, 4255H, 4260
Ion microscopes 0780
Ion microscopy 0780, 6116F
Ion-molecule collisions 34
Ion optics 4180G
Ion plating 8115J, 8160
Ion pumps 0730C
Ion recombination 34
Ion sources 0777, 2925
Ion-surface impact 7920N
Ionic conduction in solids 6630
Ionisation 52, 5280, 79
Ionisation counters 2940
Ionisation gauges 0730D
Ionisation potentials 3510H, 3520V
Ionoluminescence 7860H
Ionosphere 9420
Irreversible thermodynamics 0570
Ising lattices 0550
Ising model 7510H, 7540D
Isobaric analog resonances 2430
Isobaric analog states 2430
Isotope effects 3130
Isotope enrichment 2842H
Isotope separation 2842H, 3510B
Isotopes 30, 3510B
Isotropic turbulence 4725C
IV-VI semiconductors 7220, 7280

Jahn-Teller effect 3130, 7170C
Jets 4755C
Josephson effect 7450
Joule-Thomson effect 5130
Junction lasers 4255P, 4260
Jupiter 9630K

K-harmonics model 2160G
Kaon absorption 2580
Kaon-baryon interactions 1375J, 1385
Kaon-baryon scattering 1375J, 1385
Kaon capture 2580
Kaon decays 1320, 1325
Kaon-nucleus reactions 2580
Kaon-nucleus scattering 2580
Kaons 1440
Kapitza resistance 6740, 6830
Kidney 87
Kinetic theory 0520
KKR calculations 7110, 7125C
Knight shift 7660C
Knock-on reactions 2450
Knudsen flow 4745
Kondo effect 7215Q, 7520H
Kronig-Penney model 7110, 7125C

Laboratory apparatus and techniques 0150, 0660, 0670, 07
Laminar flows 4715
Laminates 81
Landau levels 7145
Laser accessories 4260
Laser beam applications 4260K
Laser beam effects 4260H, 6180B, 7920D
Laser beam modulation 4260F
Laser beam properties 4260H
Laser cavity resonators 4260D
Laser system design 4260B
Laser theory 4255B
Laser velocimeters 0630G, 4260K, 4780
Lasers 4255, 4260
Latent heat 0570, 64, 6550, 8260
Lattice constants 6150, 6155, 6160, 6165
Lattice dynamics 63
Lattice energy 6150L
Lattice field theory 1110
Lattice localised modes 6320P
Lattice phonons 6320
Lattice theory and statistics 0550
LCAO calculations 3120, 7110
Least squares analysis 0250
Lee model 1110
Lenses 4278
Lepton decays 1335
Lepton electromagnetic interactions 1310
Lepton-lepton scattering 1310
Lepton mass 1460
Lepton-nucleus reactions 2530
Lepton-nucleus scattering 2530
Lepton parity 1460
Lepton spin 1460
Lepton weak interactions 1310
Leptonic decays 1320, 1330, 1335
Leptons 1460
Level crossing 3280B, 3380B
Light 42
Light absorption 4210, 4220, 5170, 78
Light coherence 4210, 4220, 4250

Classification
Light interference 4210, 4220
Light interferometry 0760L
Light modulation 4260F, 4280K
Light polarisation 4210, 4220
Light propagation 4210, 4220
Light scattering 4210, 4220, 5170, 78
Light sensitive materials 4270G
Light sources 4272
Light transmission 4210, 4220
Lightning 9260
Linear accelerators 2915
Lipid bilayers 8720, 8725
Liquid crystal phase transformations 6130, 6470M
Liquid crystals 6130
Liquid helium 3-4 mixtures 6760
Liquid helium-3 6750
Liquid helium 67
Liquid lasers 4255M, 4260
Liquid metal embrittlement 6220M, 8140N, 8160
Liquid phase epitaxial growth 6855, 8115L
Liquid semiconductors 6125, 7120, 7220, 7280P
Liquid structure 6120, 6125
Liquid theory 6120, 6130
Liquid-vapour transformations 6470F
Liver 87
Localized electron states 7150
Lorentz invariance 1130
Lorentz transformation 0330
Low energy electron diffraction 6114H, 6820
Low mass nuclear reactions 2510
Low temperature techniques 0720M
LPE 6855, 8115L
Lubrication 4630P, 6220P, 8140P
Luminescence 3250, 3350, 7855, 7860
Lung 87

Mach number 4740
Macromolecules 3620
Magnetic aftereffect 7560L
Magnetic anisotropy 7530G
Magnetic annealing 7560N, 8140E
Magnetic breakdown 7125H
Magnetic bubbles 7570K
Magnetic circular dichroism 3345C, 7820L
Magnetic cooling 0720M, 7530S
Magnetic domains 7560C, 7570K
Magnetic fields 4110
Magnetic hysteresis 7560E
Magnetic lenses 4180
Magnetic materials 75, 7550
Magnetic monopoles 1480
Magnetic phenomena in gases 5160
Magnetic properties of substances 5160, 75, 8140R
Magnetic relaxation 5160, 76
Magnetic resonance 3220B, 3325, 76
Magnetic resonance spectrometers 0758
Magnetic semiconductors 7220, 75
Magnetic storms 9430
Magnetic thin films 7570
Magnetic transitions 7530K, 7540
Magnetic traps 5255
Magnetic variables measurement 0755
Magnetisation 7430C, 7560
Magnetism 41, 5160, 75
Magneto-optical effects 3345, 5160, 5170, 7820L
Magnetoacoustic effects 5140, 5160, 7125, 7255, 7580
Magnetocaloric effects 7530S
Magnetocardiography 8740, 8760D
Magnetoelastic effects 7580
Magnetoelectric effects 5150, 5160, 7580
Magnetohydrodynamic conversion 5230, 8630L
Magnetohydrodynamic waves 4765, 5235, 7230
Magnetohydrodynamics 4765, 5230
Magnetomechanical effects 7580
Magnetometers 0755, 9385
Magnetoresistance 7215G, 7220M
Magnetosphere 9430
Magnetostatic waves 75
Magnetostatics 4110D
Magnetostriction 7580
Magnetrons 0750
Magnons 7530D, 7650
Majorana-Weyl fields 0450
Mandelstam representation 1150
Many-body problems 05, 9510C
Many-body reaction theory 2410
Marine geology 9150
Markov processes 0540
Mars 9630G
Martensitic transformations 6470K, 8130K
Masers 4252
Mass differences 1340D
Mass formulae 1240K, 1270
Mass spectra 3510B, 3520X
Mass spectrometers 0775

Classification
Mass spectroscopic chemical analysis 8280
Mass transfer 0560
Materials preparation 8120
Materials science 81
Materials testing 8170
Mathematical computing 0270
Mathematics 02
Maxwell equations 0350, 4110
MBE 6855, 8115G
Measurement 06
Mechanical birefringence 4210, 7820F
Mechanical contact 4630P
Mechanical energy storage 8640C
Mechanical impact 4630P
Mechanical properties of substances 4630, 4660, 62, 8140
Mechanical property measurement 4630R
Mechanical strength 4630, 6220, 8140
Mechanical testing 8170
Mechanical waves 4630M, 6230
Mechanics 0320, 0340, 46
Mechanoception 8738
Medical diagnosis 8770E
Medical effects of radiation 8750
Medical physics 87
Medical uses of radiation and radioactivity 8760
Medicine 87
Meissner effect 7430C
Melting 6470D
Membrane biophysics 8720
Membranes 5120, 6610, 8265, 8720, 8725
Mercury (planet) 9630D
Meson absorption 2580
Meson capture 2580
Meson decays 1320, 1325
Meson electric moments 1340F, 1440
Meson magnetic moments 1340F, 1440
Meson mass 1440
Meson-meson interactions 1375L, 1385
Meson-meson scattering 1375L, 1385
Meson-nucleon interactions 1375, 1385
Meson-nucleon scattering 1375, 1385
Meson-nucleus reactions 2580
Meson-nucleus scattering 2580
Meson parity 1440
Meson production 1360K, 1365, 1375, 1385
Meson resonance production 1360M, 1365, 1375, 1385
Meson resonances 1440
Meson spin 1440
Mesons 1440
Mesosphere 9260
Metal corrosion 8160B
Metal-insulator boundaries 7340N
Metal-insulator-metal structures 7340R
Metal-insulator-semiconductor structures 7340Q
Metal-insulator transition 7130
Metal oxidation 8160B
Metal-semiconductor-metal structure 7340S
Metallography 8170
Metallurgy 81
Metamagnetism 7530K
Meteorites 9650M
Meteorology 9260
Meteors 9650K
Microphones 4385, 4388
Microscopes 0760P
Microtrons 2920
Microwave-optical double resonance 3335H, 7670H
Microwave spectra 3220B, 3320B, 7870G
Microwave spectrometers 0758, 0765
Mictomagnetism 7540
MINDO calculations 3120N
Mineralogy 9160
Mirrors 4278
Mixed conductivity 7260
Mixed state 7460E
Mixed valence states 7170C
Mixing 6475
Moderators 2842
Moire fringes 0760, 4210
Molecular beam epitaxial growth 6855, 8115G
Molecular beam reactions 8240D
Molecular beams 3440, 3450, 3580, 8240D
Molecular biophysics 8715
Molecular clusters 3640
Molecular collisions 34
Molecular configurations 3520B
Molecular dissociation 3380G, 3480G
Molecular dynamics 3520Y
Molecular electric moments 3520M
Molecular electron correlations 3120T
Molecular electron impact ionisation 3480G
Molecular electronic states 31
Molecular fine structure 3520S
Molecular fluorescence 3350
Molecular hyperfine interactions 3130
Molecular hyperfine structure 3520S
Molecular inelastic collisions 3450
Molecular magnetic moments 3520M

Classification
Molecular magnetic susceptibility 3520M
Molecular moments 3520M
Molecular nuclear coupling 3325
Molecular orbitals 3120
Molecular orbitals calculations 3120
Molecular phosphorescence 3350
Molecular photodissociation 3380G
Molecular physics 30
Molecular polarisability 3520M
Molecular predissociation 3380G
Molecular rotation 3310, 3520P
Molecular rotation-vibration 3310, 3450E, 3520P
Molecular solids 3170K
Molecular spectra 3320
Molecular structure 31, 3520B
Molecular symmetry 3520B
Molecular transitions 3110
Molecular vibration 3310, 3520P, 6320, 7830
Molecule-surface impact 34, 7920N, 7920R
Molecules 30
Monochromators 0785, 4280D
Monolayers 6845, 8265
Monte Carlo methods 0250
Moon 9620
Morin temperature 7530K, 7540
Mossbauer effect 2430, 2520, 3340, 7680
Muffin-tin potential 7110, 7125C
Multi-Regge models 1240S
Multiperipheral models 1240S
Multiphase flow 4755K
Multiphoton spectra 3280K, 3380K
Multiple stars 9780
Multiwire proportional chambers 2940
Muon absorption 2530
Muon capture 2340, 2530
Muon-hadron interactions 1360
Muon-hadron scattering 1360F
Muon-nucleus reactions 2530
Muon-nucleus scattering 2530
Muon spin rotation 7690
Muons 1460
Muscle 87
Musical acoustics 4375

N/D method 1150
NDT 8170
Nebulae 9840
Neel temperature 7530K, 7540
Negative resistance 7220H
Nematic liquid crystals 6130, 6470M
Neptune 9630T
Neurophysiology 8730, 8732E
Neutral currents 1140, 1230
Neutrino interactions 1315
Neutrino-nucleus reactions 2530
Neutrino-nucleus scattering 2530
Neutrino scattering 1315
Neutrinos 1460
Neutron absorption 2540, 2820
Neutron diffraction crystallography 6112
Neutron diffraction examination of materials 6112, 7525
Neutron diffusion 2820
Neutron effects 51, 6180H
Neutron-hyperon interactions 1375E, 1385
Neutron-hyperon scattering 1375E, 1385
Neutron induced fission 2540, 2585
Neutron-kaon interactions 1375J, 1385
Neutron-kaon scattering 1375J, 1385
Neutron-meson interactions 1375, 1385
Neutron-meson scattering 1385
Neutron moderation 2820
Neutron-neutron interactions 1375C, 1385
Neutron-neutron scattering 1375C, 1385
Neutron-nucleus reactions 2540
Neutron-nucleus scattering 2540
Neutron physics 2820
Neutron-pion interactions 1375G, 1385
Neutron-pion scattering 1375G, 1385
Neutron-proton interactions 1375C, 1385
Neutron-proton scattering 1375C, 1385
Neutron radiative capture 2540
Neutron radiography 8170, 8760J
Neutron scattering 2820
Neutron sources 2925
Neutron spectroscopy 2930
Neutron stars 9760J
Neutron transport 2820
Neutrons 1420
Nightglow 9410Q
Nilsson model 2160C
NMR 3220B, 3325, 7430G, 7660
Nomenclature and symbols 01
Nomograms 0260
Non-Abelian fields 1110
Non-Newtonian dynamics 4750
Non-Newtonian flows 4750
Noncollisional ionisation 3490
Noncrystalline state structure 6140
Nondestructive testing 8170
Nonequilibrium flows 4770

Classification
Nonhomogeneous flows 4755
Nonlinear acoustics 4325
Nonlinear field theory 1110
Nonlinear optics 4265
Nonlinear optics theory 4265B
Nonlinear symmetries 1130
Nonlocal field theories 1110
Normalising 8140G
Novae 9730
Nozzles 4755E
NQR 3325, 7660G
Nuclear backbending 2110, 2110H
Nuclear binding energy 2110D
Nuclear bombardment target 2925
Nuclear charge 2110F
Nuclear chemistry 8255
Nuclear cluster model 2160G
Nuclear collective levels 2110
Nuclear collective models 2160E
Nuclear collective resonances 2430
Nuclear Coulomb effects 2110
Nuclear cranking model 2160E
Nuclear decay 23
Nuclear deformation 2110F
Nuclear electric moments 2110K
Nuclear electromagnetic transitions 2320
Nuclear electronics 2960
Nuclear emulsions 2940
Nuclear energy 8610N
Nuclear energy level lifetimes 2320C
Nuclear energy level schemes 2110, 2110M
Nuclear energy level transitions 2320
Nuclear energy levels 2110, 2110M
Nuclear energy states 2110, 2110M
Nuclear engineering 28
Nuclear engineering computing 2841, 2980
Nuclear explosions 2870
Nuclear fireballs 2460
Nuclear fission 2475, 2585
Nuclear forces 2130
Nuclear form factors 2110F
Nuclear g-factors 2110K
Nuclear giant resonances 2430
Nuclear hole states 2110
Nuclear information processing 2980
Nuclear instrument control 2980
Nuclear instrumentation 2880, 29
Nuclear isobaric spin 2110H
Nuclear magnetic moments 2110K
Nuclear magnetic resonance 3320B, 3325, 7430G, 7660
Nuclear mass 2110D
Nuclear matrix elements 2320
Nuclear matter 2165
Nuclear medicine 8760J, 8770
Nuclear models 2160
Nuclear optical model 2410H
Nuclear Overhauser effect 3335
Nuclear parity 2110H
Nuclear physics 20
Nuclear polarisation in liquids and solids 7660
Nuclear power 28
Nuclear pumped lasers 4255, 4260
Nuclear quadrupole resonance 3325, 7660G
Nuclear radius 2110F
Nuclear reaction models 2410
Nuclear reactions 24, 25
Nuclear resonance reactions 2430
Nuclear resonances 2430
Nuclear rotational bands 2110
Nuclear shape 2110F
Nuclear shell model 2160C
Nuclear single particle levels 2110
Nuclear size 2110H
Nuclear spectroscopic factors 2110J
Nuclear spin 2110H
Nuclear statistical models 2460
Nuclear structure 21
Nuclear structure models 2160
Nuclear transition probabilities 2320C
Nucleation 6150C, 64, 6855, 8140
Nucleon decays 1330
Nucleon-hyperon interactions 1375E, 1385
Nucleon-hyperon scattering 1375E, 1385
Nucleon-kaon interactions 1375J, 1385
Nucleon-kaon scattering 1375J, 1385
Nucleon-meson interactions 1375, 1385
Nucleon-meson scattering 1375, 1385
Nucleon-nucleon interactions 1375C, 1385
Nucleon-nucleon scattering 1375C, 1385
Nucleon-nucleus reactions 2540
Nucleon-nucleus scattering 2540
Nucleon-pion interactions 1375G, 1385
Nucleon-pion scattering 1375G, 1385
Nucleons 1420
Numerical analysis 0260
Numerical methods 0260

Observatories 9545
Occultations 9510
Oceanography 9210
Ohmic contacts 7340

Classification
Oil 8610B
Omega mesons 1440
One-dimensional conductivity 7215N
One-meson exchange models 1240R
Opalescence 7820
Optical beam splitters 4280
Optical bistability 4265, 4280
Optical choppers 4280E
Optical coatings 4270, 4278H, 4280
Optical coherent transients 4265G
Optical collimators 4280
Optical communication devices 4280S
Optical constants 5170, 7820D
Optical couplers 4280L, 4280M
Optical deflectors 4280E
Optical design techniques 4278, 4280
Optical diaphragms 4280E
Optical dispersion 4210, 4220, 5170, 7820
Optical double resonance 3335, 7670H
Optical elements 4278, 4280
Optical fabrication 4285
Optical fibres 4280M
Optical films 4270, 4278, 4280, 7865
Optical filters 4280B, 4280C
Optical frequency conversion 4265C
Optical glass 4270C
Optical gratings 4280F
Optical harmonic generation 4265C
Optical images 4230
Optical information processing 4230
Optical instruments 0760, 4278, 4280
Optical Kerr effect 4265J
Optical materials 4270
Optical model 1240P
Optical modulation 4260F, 4280K
Optical monochromators 4280D
Optical parametric devices 4265C
Optical phase conjugation 4265F
Optical phenomena in gases 5170
Optical prisms 4278, 4280
Optical projectors 4278
Optical properties of substances 5170, 78, 8140T
Optical pumping 3280B, 3380B, 4255, 7845
Optical rangefinders 4280
Optical resolving power 4230
Optical rotation 4210, 7820E
Optical saturable absorption 4265G
Optical saturation 4265G
Optical self-focusing 4265J
Optical self-induced transparency 4265G
Optical shutters 4280E
Optical sources 4272
Optical storage 4230, 4240
Optical susceptibility 77, 78
Optical systems 0760, 4278, 4280
Optical telescopes 0760, 4278, 9555
Optical testing 4278, 4285
Optical transfer function 4230
Optical waveguide components 4280L
Optical waveguides 4280L
Optical windows 4280E
Optical workshop techniques 4285
Optical zone plates 4280B
Optics 0760, 0765, 42
OPW calculations 7110, 7125C
Orbital calculation methods 3120
Order-disorder transformations 6150K, 6460, 6470K, 8130H
Orthotics 8770J
Otology 8730
Overhauser effect 3325
Oxidation 8160, 8160B, 8230
Ozonosphere 9260

P invariance 1130
p-n junctions 7340L
Pacemakers 8770J
Pade scattering 1180
Palaeomagnetism 9125
Paramagnetic properties of substances 5160, 7520
Paramagnetic resonance 3330, 7630
Partially conserved currents 1140
Particle beam diagnostics 2925
Particle beams 4180
Particle optics 4180
Particle telescopes 2970
Particle track visualisation 2940
Parton models 1235H
Passivation 8160
Paste rheology 4660
Patient care 8770G
Patient diagnosis 8770E
Patient monitoring 8770
Patient treatment 8770G
PCILO calculations 3120N, 3120T
Peculiar stars 9730
Peierls instability 7130, 7215N
Peripheral models 1240R
Permittivity 5150, 7720
Petrology 9160, 9165

	Classification
Phase diagrams	6470, 8130B, 8130D
Phase equilibrium	0570, 64, 8130B, 8130D
Phase transformations	0570, 64, 8130
Phi mesons	1440
Philosophy of science	0170
Phonon interactions	6320
Phosphorescence	3250, 3350, 7855
Phosphorescence microwave double resonance	3335H, 7670H
Photoacoustic effect	4388, 6265
Photocapacitance	7240
Photocathodes	7960
Photochemistry	8250
Photochroism	7820
Photoconductivity	7240
Photodetachment	3280F, 3380E
Photodielectric effect	7240
Photodisintegration	2520
Photoelasticity	4630C, 4630R, 7820F, 8140J
Photoelectric conversion	8630J
Photoelectricity	7240
Photoelectrochemical conversion	8630K
Photoelectromagnetic effects	7240
Photoelectron spectra	3280F, 3365, 7960
Photoemission	7960
Photofission	2520, 2585
Photography	0768, 8250, 9575
Photoionisation	3280F, 3380E
Photoluminescence	3250, 3350, 7855
Photolysis	8250
Photomagnetic effect	7520, 7590
Photometry	0760D, 9575
Photomultipliers	0760D, 2940
Photon counting	0762, 4250
Photon echo	4265G
Photon-hadron interactions	1360
Photon-hadron scattering	1360F
Photon-nucleus scattering	2520
Photon sources	2925
Photons	1480
Photonuclear reactions	2520
Photoplasticity	4630J, 6220F, 8140L
Photorefractive effect	4240, 4270G, 7820
Photosphere	9660
Photosynthesis	8630P, 8725
Photothermal conversion	8630S
Photovoltaic effects	7240
Physical chemistry	82
Physical optics	42
Physiological models	8710
Physiological optics	8732
Physiology	87
Pick-up reactions	2450
Piezoelectricity	7760
Piezoreflectance	7820H
Piezoresistance	7220F
Pinch effect	5255
Pion absorption	2580
Pion-baryon interactions	1375G, 1385
Pion-baryon scattering	1375G, 1385
Pion capture	2580
Pion decays	1320, 1325
Pion-nucleus reactions	2580
Pion-nucleus scattering	2580
Pions	1440
Pipe flow	4760
Plane wave Born approximations	2410
Planetary nebulae	9840
Planets	9630, 9780
Plasma	52
Plasma antennas	5240F
Plasma applications	5275
Plasma arc spraying	5275, 8115, 8160
Plasma beam interactions	5240M
Plasma collision processes	5220F, 5220H
Plasma confinement	5255
Plasma deposited coatings	6855, 8115J, 8160
Plasma deposition	8115J
Plasma devices	5275
Plasma diagnostics	5270
Plasma electromagnetic wave propagation	5240D
Plasma elementary processes	5220
Plasma equilibrium	5255
Plasma-filled waveguides	5240F
Plasma flow	5230
Plasma heating	5250
Plasma heating by laser beam	5250J
Plasma heating by shock wave	5250L
Plasma heating by wire explosion	5250L
Plasma magnetohydrodynamics	5230
Plasma oscillations	5235
Plasma production by laser beam	5250J
Plasma production by shock wave	5250L
Plasma production by wire explosion	5250L
Plasma radiation	5225P
Plasma sheaths	5240K
Plasma shock waves	5235T
Plasma simulation	5265
Plasma sources	5250
Plasma transport processes	5225F
Plasma turbulence	5235R
Plasma-wall interactions	5240H

	Classification
Plasma waves	5235
Plasmons	7145G, 7230
Plastic crystals	6150, 7660
Plastic deformation	4630J, 6220F, 8140L
Plastic detectors	2940
Plasticity	4630J, 6220F, 8140L
Plastics	6140K, 81
Plate tectonics	9145
Pleochroism	3345, 7820F
Pluto	9630T
Pneumodynamics	8745
Poincare invariance	1130
Point contacts	7340
Point defects	6170B, 6170D, 6170E, 7850
Poiseuille flow	4760
Poisson ratio	6220D, 8140J
Polar semiconductors	7220, 7280
Polarimeters	0760F, 2975
Polarimetry	2975
Polarised bombardment targets	2925
Polarised nuclear reactions	2470
Polarised sources	2925
Polaritons	6320, 7136, 7830
Polarography	8280
Polarons	7138
Polishing	4285, 8160, 8170
Pollution	8670, 9220, 9260
Polymer films	6140K, 6855, 81
Polymer melts	4750, 6125
Polymer molecules	3620
Polymer preparation	8120S, 8120T
Polymer reactions	8235
Polymer solutions	4750, 6125
Polymerisation	8235
Polymers	3620, 6140K, 81
Polymorphic transformations	6150K, 6470K, 8130H
Polymorphism	6150K, 6155, 6160, 6165
Pomeranchuk poles	1240M
Population II stars	9720
Population inversion	3280B, 3380B, 4250, 4255, 7845
Porous materials	4755M, 81
Position sensitive detectors	2940
Positron annihilation in liquids and solids	6180F, 7125, 7870B
Positron states	7165
Positrons	1460
Potential energy curves	3190
Potential energy surfaces	3170F, 8220K
Potential models	1240Q
Potts model	0550
Powder metallurgy	8120E, 8120G
Powder spraying	8115, 8160
Powder technology	8120E
Powders	4755K, 8120
PPP calculations	3120P
Pre-equilibrium model	2460
Preacceleration	2910
Precipitation	6475, 8130M, 8260
Precipitation hardening	8140C
Primary cells	8630E
Probability theory	0250
Proportional counters	2940
Prosthetics	8770J
Protective coatings	8160
Proteins	3620, 8715
Proton absorption	2540
Proton-hyperon interactions	1375E, 1385
Proton-hyperon scattering	1375E, 1385
Proton-kaon interactions	1375J, 1385
Proton-kaon scattering	1375J, 1385
Proton magnetic resonance	3325, 7660
Proton-meson interactions	1375, 1385
Proton-meson scattering	1375, 1385
Proton-neutron interactions	1375C, 1385
Proton-neutron scattering	1375C, 1385
Proton-nucleus reactions	2540
Proton-nucleus scattering	2540
Proton-pion interactions	1375G, 1385
Proton-pion scattering	1375G, 1385
Proton-proton interactions	1375C, 1385
Proton-proton scattering	1375C, 1385
Proton radiative capture	2540
Protons	1420
Pseudopotential methods	7110, 7125C
Psi mesons	1440
Pulsars	9760G
Pulsatile flow	4760
Pulse amplifiers	2960
Pulse counting	2960
Pulse height analysers	2960
Pulse shaping circuits	2960
Pyroelectricity	7770
Pyrometers	0720, 0762
Q-switching	4260F
QCD	1235C
QED	1220
Quadrupole moments	2110K, 3520M, 7660
Quantum electrodynamics	1220
Quantum field theory	0370, 1110

	Classification
Quantum fluids	0530, 67
Quantum gravity	0460
Quantum measurement theory	0365
Quantum mechanics	0365
Quantum optics	4250
Quantum statistical mechanics	0530
Quark confinement	1235C
Quark models	1235
Quarks	1480
Quasars	9870J
Quenching (thermal)	8140G
Radiation angular correlations	2970
Radiation belts	9430
Radiation chemistry	8250
Radiation coincidence measurements	2970
Radiation detectors	0762, 2940, 2970
Radiation effects	5190, 6180
Radiation gas dynamics	4770
Radiation hardening	8140C
Radiation measurement	2970
Radiation monitoring	2880, 2940, 2960, 2970, 8760P
Radiation monitoring electronics	2960
Radiation protection	2880, 8760P
Radiation spectrometers	2930
Radiation spectroscopy	2930
Radiation therapy	8760B, 8760G, 8760J, 8770G
Radiative effects	3130
Radiative flows	4770
Radiative transfer	0560, 4440, 9265, 9530, 9710
Radioactive dating	0790, 9385
Radioactive decay periods	23
Radioactive decay schemes	23
Radioactive pollution	8670, 8760R
Radioactive sources	2925
Radioactive tracers	2925, 8760J, 8760L
Radioactive waste	2842
Radioactivity	23, 2880
Radioactivity measurement	2970
Radioastronomy	95
Radiobiology	8750G
Radiochemistry	8255
Radiofrequency spectra	3220B, 3320B, 7870G
Radiofrequency spectrometers	0758, 0765
Radiography	0785, 8170, 8760J, 8770E
Radioisotope scanning and imaging	8760J, 8770E
Radiometry	0760D
Radiosources (astronomical)	9870D
Rain	9260
Raman lasers	4255, 4260, 4265C
Raman spectra	3320F, 7830
Random noise	0250, 7270
Random phase approximations	2160J, 7110, 7145
Random processes	0540
Rarefied gas dynamics	4745
Rayleigh scattering	3320F, 4265C, 7835
Reaction kinetics	8220, 8240
Reactive flows	4770
Recrystallisation	6150C, 8110J, 8140E
Reflection high energy electron diffraction	6114H
Reflectivity	42, 4210, 4220, 5170, 78
Reflectometry	0760H
Refractive index	4110H, 4210, 4220, 5170, 7820D
Refractometers	0760H
Refractories	81
Refractory preparation	8120L, 8120N
Regge poles	1160, 1240M
Relativistic band structure calculations	7110, 7125C
Relativistic effects	3130, 3510F
Relativistic field theory	1110
Relativistic flows	4775
Relativistic mechanics	0330
Relativistic plasmas	5260
Relativistic scattering theory	1180
Relativity	04, 9530
Remote sensing	8670L, 9385
Renormalisable fields	1110
Replica techniques	0780, 6116, 68
Resistance thermometers	0720D
Resource letters	0130R
Reverberation	4355
Reviews	0130R
Rheopexy	4660
Rho mesons	1440
Ring lasers	4260D
Rock magnetism	9160
Rotational energy transfer	3450E
Rotational flow	4730
Rotational isomerism	3520J
RPA calculations	2160J, 7110, 7145
S-matrix theory	1120
SAMO method	3120G

Classification
Satellites 9480, 9630
Saturn 9630M
Scaling phenomena 1130
Scanning radiography 0785, 8170, 8760J, 8770E
Scattering 0365, 0380
SCF calculations 3120, 7110, 7125, 7170
Schlieren devices 4280
Schottky defects 6170B
Schottky effect 7330, 7940
Schrodinger equation 0365
Schwinger source theory 1110
Scintillation counters 2940
Second sound 67
Secondary cells 8630F
Secondary emission 7920
Segregation 6475, 8130M
Seismology 9130
Self-diffusion 51, 66
Self-focusing 4265J
Self-induced transparency 4265G
Semiconductor counters 2940
Semiconductor doping 6170T
Semiconductor-electrolyte boundaries 7340M
Semiconductor growth 6150C, 6855, 8110, 8115
Semiconductor-insulator boundaries 7340Q
Semiconductor junction lasers 4255P, 4260
Semiconductor junctions 7340L
Semiconductor materials 7280
Semiconductor metal boundaries 7340N
Semiconductor thin films 7360F
Semiempirical NDO calculations 3120N
Semileptonic decays 1320, 1330, 1335
Semimetallic thin films 7360F
Sensory aids 8770J
Sets 0210
Shape memory effects 6220F, 8130K, 8140L
Shear modulus 6220D, 8140J
Shear turbulence 4725F
Shielding 2842, 2880
Shock waves 4630M, 4740N, 6250
Sintering 8120E
Size effect 7230, 7360
Skin effect 7230
Slip 4630J, 6170L, 6220F, 8140L
Slip flows 4745
Slug flow 4755K
Smectic liquid crystals 6130, 6470M
Societal aspects 0175
Solar absorbers 8630S
Solar cells 8630J
Solar collectors 8630S
Solar energy 8610K
Solar energy concentrators 4278, 8610K
Solar nebula 9610
Solar system 96
Solar wind 9440H, 9460, 9660
Solid helium 6780
Solid instability 4630L
Solid lasers 4255R, 4260
Solid-liquid transformations 6470D
Solid rheology 4630
Solid solubility 6475, 8130
Solid solution hardening 8140C
Solid state detectors 2940
Solid state phase transformations 6470K, 8130H
Solid-state plasma 7230
Solid-vapour transformations 6470H
Solidification 6470D, 8130F
Sols 4755K, 8270
Solubility 6475, 8130
Solutions 6120, 6125, 6475
Solvent effects 3170D
Sonar 4330, 9210, 9385
Sonoluminescence 7860M
Sorption 6845, 8265
Space charge 52, 5280, 7750
Space groups 6150E
Space physics 94
Space research 9480
Space-time configurations 04
Spallation breeder reactors 2858
Spallation reactions 2450, 2540
Spark chambers 2940
Spatial filters 4280B
Special relativity 0330
Specific heat 4450, 5130, 6520, 6540, 7430E, 7540
Speckle 4220
Spectra 32, 3320, 78
Spectrochemical analysis 8280
Spectrophotometers 0760D, 0765
Spectroscopy 0758, 0765, 0775, 9575
Speech 4370, 8736
Speech communication 4370
Spheroidizing 8140G
Spin density waves 75
Spin glasses 7540
Spin-lattice relaxation 76
Spin-orbit interactions 2110, 2160, 31, 7170E
Spin-phonon interactions 6320, 75, 76

Classification
Spin-spin relaxation 3325, 3330, 76
Spin waves 7530D, 7650
Spinoidal decomposition 6475, 8130
Spontaneous fission 2585
Spontaneous symmetry breaking 1130
Spray coating techniques 8115, 8160
Sputter etching 8160
Sputtered coatings 6855, 8115C
Sputtering 7920, 8115C
Stacking faults 6170P
Stark effect 3260, 3345B, 7170E, 7820J, 7830, 7840
Stars 97
Statistical models 1240E
Statistical physics 05
Statistics 0250
Stellar clusters 9820
Stellar motion 9810
Stellarators 5255, 5275
Stereochemistry 3520B
Stimulated Brillouin scattering 4265C
Stimulated emission 4250, 4255, 7845
Stimulated light scattering 4265C
Stimulated Raman scattering 4265C
Stochastic processes 0250, 0540
Storage rings 2920
Strain gauges 0710, 4630R
Strange particles 1420, 1440
Stratified flow 4755H
Stratons 1480
Stratosphere 9260
Streamer chambers 2940
Stress corrosion cracking 6220M, 8160, 8160B
Stress relaxation 4630J, 6240, 8140J
Stress/strain relations 46, 6220F, 8140L
Stripping reactions 2450
Strong gravity 0460
Strong interaction models 1240
Structure functions 1340F
SU_2 theory 1130
SU_3 theory 1130
SU_4 theory 1130
Sublimation 6470H
Subsonic flows 4740D
Substrates 6855, 6860, 8115
Sum rules 1150
Sun 9660
SU_N theory 1130
Superconducting materials 7470
Superconducting semiconductors 7470
Superconducting thin films 7360K
Superconductive tunnelling 7450
Supercooling 64
Superexchange interactions 7530E
Superfluidity 0530, 67
Supergiant stars 9720
Supergravity 0465
Superionic conducting materials 6630
Superlattices 6155, 6160, 6165, 7340L, 8130, 8140
Supernova remnants 9840
Supernovae 9760B
Superparamagnetism 75
Superradiance 3290, 4250, 7845
Supersonic flows 4740K
Supersymmetry 1130
Surface acoustic wave devices 4360, 4385, 4388
Surface acoustic waves 4320, 4325, 4360, 4388, 6825
Surface carrier scattering 7325
Surface electron states 7320
Surface energy 6810, 6840
Surface hardening 8160, 8160B
Surface ionisation 7330, 79
Surface reactions 8270
Surface structure 6820
Surface tension 6810
Surface texture 6820
Surface treatment 8160, 8160B
Surgery 8770G
Suspensions 8270
Synchrocyclotrons 2920
Synchrotron radiation 4170, 4272
Synchrotrons 2920
Synergetic fission reactor systems 2858

T invariance 1130
Tachyons 1480
Tandem accelerators 2915
Teaching 0140, 0150
Tectonics 9145
Telescopes 0760, 4278, 9555
Tempering 8140G
Tensile strength 6220F, 8140L
Terrestrial atmosphere 9260, 94
Terrestrial electricity 9125
Terrestrial heat 9135
Textbooks 0130M, 0130P
Texture 8140E
Thermal blooming 4265J

Classification
Thermal conductivity 0570, 0720, 4450, 5130, 6660, 6670, 7215C, 7215E, 7430E
Thermal diffusion in gases 5110, 5120
Thermal diffusion in liquids 4725J, 6610
Thermal energy conversion 8630R
Thermal energy storage 8640F
Thermal expansion 5130, 6570
Thermal processes 44
Thermal properties 4450
Thermal properties of gases 5130
Thermal property measurement 4450
Thermal quenching 8140G
Thermally stimulated currents 7220J, 7730
Thermionic conversion 8630N
Thermionic emission 7940
Thermo-optical effects 5130, 5170, 7820N
Thermochemistry 82
Thermocouples 0720, 0762
Thermodynamic properties 6550
Thermodynamics 0570, 4460
Thermoelasticity 4630C, 4660, 6220D, 8140J
Thermoelectric conversion 8630M
Thermoelectricity 7215J, 7220P
Thermoluminescence 7860K
Thermoluminescent dating 0790, 9385
Thermoluminescent dosimeters 2940, 2970
Thermomagnetic effects 7215H, 7220N
Thermomechanical treatment 8140G
Thermometers 0720D
Thermopiles 0720, 0762
Thickness measurement 0630C
Thin films 6855, 6860, 7360, 7570, 7755, 7865
Thixotropy 4660
Thomas-Fermi-Dirac model 3120L
Thomas-Fermi model 2160, 3120L, 7145J
Tidal energy 8610F
Tides 9110, 9210, 9410
Time measurement 0630F
Time-of-flight spectrometers 0775, 2930
Tokamaks 5275
Topology 0240
Track chambers 2940
Transducers 0670, 4388
Transition radiation 41, 6180, 7870
Transits 9510
Transonic flows 4740H
Transport processes 0560
Triboelectricity 7340B
Triboluminescence 7860M
Triplet state 3150, 7135
Triton-nucleus reactions 2550
Triton-nucleus scattering 2550
Tritons 2140, 2710
Troposphere 9260
Tube flow 4760
Tunnelling 7340, 7450
Turbidity 4220, 8270, 9210, 9265
Turbulence generated noise 4725M
Turbulent diffusion 4725J
Turbulent flows 4725
Twilight 9260, 94
Twinning 6170N
Two-phase flow 4755K

Ultrasonic absorption 43, 5140, 6260, 6265
Ultrasonic applications 43
Ultrasonic relaxation 5140, 6280
Ultrasonic velocity 43, 5140, 6260, 6265
Ultrasonic waves 43, 5140, 6260, 6265
Ultraviolet spectra 3220J, 3320L, 3320N, 7840
Umklapp process 6320H, 6320K
Underwater sound 4330, 9210
Undulator radiation 4170
Unified field theories 0450, 1210
Units (measurement) 0620F
Upsilon mesons 1440
Uranus 9630T

Vacancies (crystal) 6170B
Vacuum apparatus 0730
Vacuum deposited coatings 6855, 8115G
Vacuum deposition 8110B, 8115G, 8120C
Valence bond calculations 3120R
Van de Graaff accelerators 2915
Van de Graaff generators 0750
Van der Waals forces 3420
Vaporisation 6470F
Vapour deposited coatings 6855, 8115C, 8115G, 8115H, 8115J
Vapour deposition 8110B, 8115C, 8115G, 8115H, 8115J
Vapour phase epitaxial growth 6855, 8115G, 8115H, 8115J
Variable stars 9730
Vector meson dominance model 1240V
Velocity measurement 0630G
Veneziano moddel 1240H
Venus 9630E
Vibrating bodies 4630M

Classification
Vibrational energy transfer 3450E
Vibrational states of disordered systems 6350
Vibrations 0320, 0340K, 4340, 4630M
Viscoelasticity 4630J, 4660, 6240, 8140J
Viscometers 4780
Viscoplasticity 4630J, 6220F, 8140L
Viscosity 5110, 5120, 6210, 6620
Viscosity of gases 5120
Visible spectra 3220J, 3320K, 7840
Vision 8732
Visual perception 8732S
Visual pigments 8732L, 8732N
Vitreous state 6140, 81
Vlasov equation 5220, 5225F
Voids (solid) 6170, 6180
Volcanology 9140
Volume measurement 0630C
Vorticity 4730, 6740
VPE 6855, 8115G, 8115H, 8115J

Wakes 4725R
Water wave energy 8610F
Wave energy 8610F
Wave equations 0340K, 0365
Waves 0340G, 0340K, 4735, 4740N
Weak interaction models 1230
Weak interactions (atomic) 3510W

Classification
Weak interactions (molecular) 3520W
Wear 4630P, 6220P, 8140P
Wear resistant coatings 6220P, 8140P, 8160
Weather analysis 9260
Weighing 0630E
Weinberg-Salam model 1210
Westheimer method 3120W
Wetting 6810, 6845, 81
Whiskers (crystal) 6870
White darfs 9720
Wiberg method 3120W
Wigner functions 0365
Wind 9260, 9410
Wind energy 8610D
Woods-Saxon potentials 2160C
Work function 7330, 7340, 79
Work hardening 8140E

X-ray absorption spectra 3220R, 3320R, 7870D
X-ray apparatus 0785
X-ray astronomy 95
X-ray crystallography 6110
X-ray diffraction 6110
X-ray diffraction examination of materials 6155, 6160, 6165, 6170
X-ray effects 6180C

Classification
X-ray emission spectra 3220R, 3320R, 7870E
X-ray lasers 4255
X-ray monochromators 0785, 6110F
X-ray scattering 6110, 7870C
X-ray sources 2925
X-ray sources (astronomical) 9870Q
X-ray spectra 3220R, 3320R, 7870D, 7870E
X-ray spectroscopy 2930
Xalpha calculations 3120G

Yang-Mills fields 1110
Yield point 4630J, 6220F, 8140L
Young's modulus 6220D, 8140J
Yrast states 2110

Zeeman effect 3260, 3345B, 7170E, 7820L, 7830, 7840
Zener effect 7220H
Zener relaxation 4630J, 6240, 8140J
Zero sound 67
Zodiacal light 9460, 9650D
Zone melting 8110H
Zone refining 8110H
Zoology 87

Physics Abstracts

1st AUGUST 1983 Volume 86 Number 1213

00.00 GENERAL

01.00 COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY

01.30 PHYSICS LITERATURE AND PUBLICATIONS

01.30C Conference proceedings

69773 Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids.
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3 (1982). [received: April 1983]
Conference held at: Leningrad, USSR. Date 6-8 April 1981. The following topics were dealt with: optical detection of magnetic resonance, optical alignment and coding of electron-nuclear systems in semiconductors. 36 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant codes in this or other issues.

69774 Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter.
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.6 (1982). [received: April 1983]
Conference held at: Leningrad, USSR. Date 1-4 Dec. 1981. The following topics were dealt with: laser generated discharges in condensed media; thermophysical processes in the interaction of laser radiation with absorbing media; absorption waves in gases; gas breakdown; laser damage to materials; metal heating by a laser plasma; a laser study of metal ignition kinetics; elementary surface excitations in insulators and metals; surface oxidation by laser; laser thermochemistry; polarization instability in a light wave in a highly nonlinear medium; laser generation of strong shock waves and the examination of ultrarapid relaxation in a medium by space-time modulation of the perturbing light. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69775 Proceedings of the XVIII All-Union Conference on Emission Electronics.
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.7 (1982). [received: May 1983]
Conference held at: Moscow, USSR. Date Dec. 1981. The following topics were dealt with: adsorption, electroabsorption and thermoadsorption on crystal surfaces; work function and surface electron states; explosive electron emission and electronic structures; cathode sensitivity and photoelectron emission; secondary electron and exoelectron emission. 45 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69776 Annual Meeting of the Seismological Society of America.
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B (Dec. 1982).
Conference held at: Anaheim, CA, USA. Date 19-21 April 1982. The following topics were dealt with: earthquake proof design of buildings, public awareness of seismic hazards, strong ground motion, test ban treaty verification research, the use of computers in network seismology, theoretical seismic wave propagation problems and finally earthquake prediction. 21 papers were presented which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69777 Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC).
J. Geophys. Res. (USA), vol.87, no.C11 (20 Oct. 1982). [received: May 1983]
Conference held at: Hamburg, Germany. Date 24-27 Aug. 1982. The IAMAP Commission on Atmospheric Chemistry and Global Pollution held a symposium on The Role of the Oceans in Atmospheric Chemistry (ROAC), as part of the Third IAMAP Scientific Assembly in Hamburg, West Germany. The papers presented were divided into four sections: (i) the oceans as a source and sink for atmospheric trace gases, (ii) the chemistry of marine aerosols and their production by and deposition to the ocean; (iii) the chemistry of precipitation over the ocean; (iv) theoretical and laboratory modeling of the air/sea exchange of trace gases and aerosols. 30 papers presented at this conference are presented in this and a later issue of this journal.

69778 MICRO 82: High Resolution Electron Microscopy.
J. Microsc. (GB), vol.129, pt.3 (March 1983).
Conference held at: London, England. Date 12-16 July 1982. The following topics were dealt with: high resolution electron microscopy; imaging techniques; moire techniques; application to the study of order-disorder; defect structures, and microstructure; alloy studies. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69779 Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure'.
Metall. Trans. A (USA), vol.14A, no.4 (April 1983).
Conference held at: Dallas, TX, USA. Date 14-18 Feb. 1982. Sponsors: Mech. Metall. Committee of TMS-AIME. The following topics were dealt with: role of grain boundary segregation in diffusional creep; grain boundary sliding, stress concentration and cavity nucleation during creep; effects of trace impurities on ductility; high temperature embrittlement effect of Ce on creep behaviour of superalloys.

69780 Proceedings of the 16th International Conference on the Physics of Semiconductors.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1 (March 1983).
Conference held at: Montpellier, France. Date 6-10 Sept. 1982. Sponsors: IUPAP; Societe Francaise de Physique; European Phys. Soc. The following topics were dealt with: electronic states; shallow and deep impurity states; linear and nonlinear transport and hot electrons; excitons, polaritons and biexcitons; electron-hole liquid and plasma; optical and nonlinear optical properties; narrow gap semiconductor; semimagnetic semiconductors and spin dependent properties; lattice dynamics and electron-phonon coupling; phase transitions; low dimensional materials; intercalation and organic semiconductors; quantum wells, localisation and heterojunctions; superlattices, surfaces and interfaces; amorphous semiconductors and laser beam annealing. 293 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69781 Second Mini-Symposium on Polymer Blends, 'Polyblends '82'.
Polym. Eng. & Sci. (USA), vol.22, no.17 (mid-Dec. 1982).
Conference held at: Montreal, Canada. Date 20 April 1982. Sponsors: Nat. Res. Council Canada. The following topics were dealt with: polymer/polymer blends, their miscibility, properties, development, characterisation, economics and commercialisation; and certain aspects of injection moulding, blow moulding and extrusion. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

69782 ECOSS-5. Proceedings of the Fifth European Conference on Surface Science.
Surf. Sci. (Netherlands), vol.126, no.1-3 (March 1983).
Conference held at: Gent, Belgium. Date 24-27 Aug. 1982. The following topics were dealt with: surface electronic structure; surface vibrations; semiconductor surfaces and interfaces; surface defects; ion-surface interactions; atom scattering at surfaces; alloys and thin films. 139 papers were presented, of which 95 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69783 Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society.
Vacuum (GB), vol.33, no.1-2 (Jan.-Feb. 1983).
Conference held at: Brunn am Gebirge, Austria. Date 27-29 Oct. 1981. The following topics were dealt with: thin film growth; mass spectrometers and their applications; thin film resistors; surface structure. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69784 Evolution of the Earth. R.J.O'Connell, W.S.Fyfe [Ed.]
Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Various topics concerning the state of the early Earth and the evolution of the Earth were presented. Individual papers describe the geochemical evolution of the Earth, Earth interior temperature profiles, core and mantle physical structure, radiogenic heat, geomagnetism, plate tectonics, mantle convection, palaeoatmosphere and palaeoocean chemistry and the electrical conductivity of the mantle. 27 papers were presented which are published in full in the present proceedings.

69785 Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received).
East Lansing, MI, USA: Michigan State Univ. (1982), 151 pp.
Conference held at: East Lansing, MI, USA. Date 26 Sept.-1 Oct. 1982. Sponsors: U.S. Dept. Energy.; NSF; IUPAC; et al. The following topics were dealt with: light particle emission; fragmentation and A,Z distributions; nuclear structure and exclusive reactions; energy; momentum and angular momentum transfer; fusion and fission; reaction cross sections; theory. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69786 Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium.
Vienna, Austria: IAEA (1983), 517 pp.
Conference held at: Utrecht, Netherlands. Date 21-25 June 1982. The following topics were dealt with: radioactive waste conditioning; radwaste treatment; waste immobilisation; HLW disposal; radwaste storage; radwaste packaging methods; packaging materials. 35 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69787 Electrostatics 1983. Sixth Conference on Electrostatic Phenomena.
Bristol, England: IOP (1983), x+262 pp. [0 85498 157 8]
Conference held at: Oxford, England. Date 13-15 April 1983. Sponsors: IOP. The following topics were dealt with: electrostatic hazards, fluids, discharges, measurements, solid and industrial electrostatics and electrostatic damage to solid state devices, introducing one of the newer areas of applied electrostatics which reflects the widespread use of electronic devices housed and packaged in plastics. 39 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69788 Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium.
New York, USA: North-Holland (1982), xxiv+302 pp. [0 444 00695 8]
Conference held at: Argonne, IL, USA. Date 2-3 Nov. 1981. The following topics were dealt with: elementary particle physics; multilayer adsorption; melting; molecular dynamics method; Lennard-Jones systems; structural transformations; antiphase boundaries; correlations; the metal-insulator transition; amorphous semiconductors; localization; the laser; chaos; convecting fluids; KAM surface; intermittency; order; mappings; lattice theory and statistics; renormalization; elastic softening; Kostalitz-Thouless transition; superconductors; Anderson models; random resistor networks; graphite intercalation compounds; electronic structure; piezoelectric switching; liquid structure; spinodal decomposition; nonlinearly coupled oscillators; diffusion; biomembranes; and ϕ^4-theory. 68 papers were presented, of which 16 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69789 Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management.
New York, USA: North-Holland (1982), xxi+768 pp. [0 444 00699 0]
Conference held at: Boston, MA, USA. Date 16-19 Nov. 1981. The following topics were dealt with: radioactive waste forms; chemical properties; physical properties; geological disposal; geochemical considerations for radwaste disposal; canister-backfill interactions; near field interactions; processing complexities; non-HLW assessments; radiation effects on waste forms. 99 papers were presented, of which 92 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69790 Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting.
New York, USA: North-Holland (1982), xi+561 pp. [0 444 00698 2]
Conference held at: Boston, MA, USA. Date Nov. 1981. The following topics were dealt with: fundamentals; processing and characterization; the physical, chemical and mechanical properties of metallic glasses; the physical, chemical and mechanical properties of crystalline alloys; devitrified and microcrystalline alloys; and surface treated alloys. 70 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

69791 Chemistry of the Unpolluted and Polluted Troposphere. Proceedings of the NATO Advanced Study Institute.
Dordrecht, Netherlands: Reidel (1982), x+512 pp. [90 277 1487 8]
Conference held at: Corfu, Greece. Date 28 Sept.-10 Oct. 1981. The following topics were dealt with: measuring techniques, climate and C cycle, trace gases cycles and budgets, troposphere heterogeneous systems and air pollution.

69792 Deposition of Atmospheric Pollutants. Proceedings of a Colloquium.
Dordrecht, Netherlands: Reidel (1982), ix+217 pp. [90 277 1438 X]
Conference held at: Oberursel/Taunus, Germany. Date 9-11 Nov. 1981. The following topics were dealt with: pollutants wet and dry deposition, fog, gaseous matter removal, acid rain; deposition on plants and vegetation is considered.

69793 Atmospheric Turbulence and Air Pollution Modelling.
Dordrecht, Netherlands: Reidel (1982), xxi+358 pp. [90 277 1365 0]
Conference held at: The Hague, Netherlands. Date 21-25 Sept. 1981. The following topics were dealt with: similarity relations, scaling laws, boundary layer modelling, convective boundary layer diffusion and air pollution modelling.

69794 Sea Level Ice and Climatic Change. Proceedings of a Symposium.
Washington, DC, USA: Int. Assoc. Hydrological Sci. (1981), xv+471 pp.
Conference held at: Canberra, Australia. Date Dec. 1979. Sponsors: Int. Assoc. Hydrological Sci.; et al. The following topics were dealt with: sea level, ice, climate, snow, glaciers, Nepal, heat balance, river icing, Antarctic, Mt. Kenya, Weddell Sea, general circulation model, microparticle concentrations, Greenland, temperature, palaeogeodesy, Quaternary, eustacy, China, Holocene and orbital radiation variation.

69795 First International Conference on Optical Fibre Sensors.
London, England: IEE (1983), viii+216 pp.
Conference held at: London, England. Date 26-28 April 1983. The following topics were dealt with: temperature sensors; interferometric sensors; sensor applications; couplers and components; optical fibres; liquid level sensors and refractometers; displacement sensors; optical fibre gyroscopes and resonators; polarisation sensors; frequency modulation techniques and fluorescence sensors. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

01.30E Monographs, and collections

69796 Tectonic and geologic evolution of southeast asian seas and islands. Pt.2. D.E.Hayes.
Washington, DC, USA: American Geophysical Union (1983), 402 pp. [0 87590 053 4]
Discusses seismotectonics, Phillipine Islands, tectonics, subduction, palaeomagnetism, emplacement, geology, geochemistry, Marianas arc-trench-back arc complex, seismicity, crustal spreading, volcanism, Phillipine Sea, Molucca Sea and geochronology.

69797 Current topics in materials science. Vol.10. E.Kaldis [Ed.]
Amsterdam, Netherlands: North-Holland (1982), vi+515 pp. [0 444 86321 4]
This volume contains 5 reviews entitled as follows: Diataxy (graphoepitaxy) and other approaches to oriented crystallisation on amorphous substrates; SbSI and other ferroelectric $A^{V}B^{VI}C^{VII}$ materials; Nonstoichiometry of inorganic solids; spectroscopy, structure and bonding of high-temperature metal halide vapour complexes; and Gem materials, natural and artificial.

01.30K Handbooks, dictionaries, tables and data compilation

69798 A compilation of resonance integrals from hydrogen to fermium. E.M.Gryntakis, J.I.Kim (Inst. fur Radiochem., Tech. Univ. Munchen, Garching, Germany).
J. Radioanal. Chem. (Switzerland), vol.76, no.2, p.341-496 (1983).
The compilation comprises the experimental and calculated resonance integrals of nuclides (hydrogen to fermium), for neutron capture and fission reactions. The thermal cross-sections of the corresponding reactions are also included. Whenever possible, in addition to original values of the resonance integrals, normalized values are also given. The theoretical explanation and physical meaning of the resonance integrals determined by different approaches are briefly discussed. (439 refs.)

69799 Bound coherent and incoherent thermal neutron scattering cross sections of the elements. V.F.Sears.
Report AECL-7980, Atomic Energy Canada Ltd., Chalk River, Ont. (Dec. 1982), 24 pp.
An up-to-date table of bound coherent and incoherent thermal neutron scattering cross sections of the elements is presented. Values from two different data sources are calculated and compared. These sources are: (1) the free-atom cross sections listed in the 'barn book' and (2) the Julich scattering length tables. The authors also call attention to, and clarify, the confusion that exists in the literature concerning the sign of the imaginary part of the complex scattering length. (30 refs.)

01.30M Textbooks for graduates and researchers

69800 Fusion. Vol.1. Magnetic confinement. Part A. E.Teller [Ed.]
London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
Presents 7 chapters covering every approach to magnetic confinement fusion. The individual chapers of this graduate students' book are: Tokamak plasma stability; Tokamaks; stellarators; mirror theory; mirror confinement physics; and the reversed field pinch.

69801 Introduction to atomic and molecular collisions. R.E.Johnson.
New York, USA: Plenum (1982), xiii+288 pp. [0 306 40787 6]
The book is written at graduate level and comprises six chapters. In the first chapter, a rationale and a perspective are given for understanding the collisions of atoms and molecules. A number of collision-related macroscopic phenomena are discussed qualitatively with the role of atomic and molecular interactions delineated. In the second chapter, the notion of a cross section is developed and then related to collision quantities discussed. This is followed by a classical treatment of collisions. Background material on wave mechanics and atomic and molecular notation are given in Chapter 3 in order that students who have had only basic instruction in this area can easily follow the discussion of the wave mechanical description of collisions. The description of molecular interactions is completed in Chapter 4, where interaction potentials and transition probabilities are calculated. In Chapter 5, a summary of experimental results for cross sections and rate constants is presented and related to the cross-section models and potentials discussed earlier. This is followed, in Chapter 6, by a return to the material presented in Chapter 1.

69802 Vibrational intensities in infrared and Raman spectroscopy. W.B.Person, G.Zerbi [Ed.]
Amsterdam, Netherlands: Elsevier (1982), xvi+466 pp. [0 444 42115 7]
The following topics were dealt with: Techniques of measuring infrared and Raman intensities are described. The major part of the book deals with interpretation of these intensities. The electro-optical parameter theory and some of the results from quantum mechanical calculations are presented. Potential applications of vibrational intensities to a wide range of topics is also described.

69803 Formulas, facts and constants. For students and professionals in engineering, chemistry and physics. H.J.Fischbeck, K.H.Fischbeck.
Berlin, Germany: Springer-Verlag (1982), xii+251 pp. [3 540 11315 0]
The book provides a handy source of formulas, conversion factors and constants for everyday use. The formulas and tables are amended by examples in all of those cases where their use is not self-explanatory. Section 1 provides the fundamental tools of mathematics needed in all areas of the physical sciences. Section 2 summarizes the SI system, lists conversion factors and provides precise values of fundamental constants. Sections 3 and 4 review the basic terms of spectroscopy, atomic structure and wave mechanics. These sections serve as a guide to the interpretation of modern literature. Section 5 is a resource for work in the laboratory. Data and formulas are given to be of assistance in the use of frequently encountered equipment such as vacuum systems and electronic devices. Material constants and other data are listed for information and as an aid for estimates or problem solving.

69804 Heavy ion collisions. Vol.3. R.Bock [Ed.]
Amsterdam, Netherlands: North-Holland (1982), x+666 pp. [0 444 85352 9]
Written for graduate students entering the field and research specialists, this volume contains four chapters covering; in-beam gamma-ray spectroscopy; hyperfine interactions in isolated ions; on-line mass spectroscopy; and some current aspects of atomic collisions between heavy ions.

69805 Masers and lasers. An historical approach. M.Bertolotti.
Bristol, England: Adam Hilger (1983), xii+268 pp. [0 85274 536 2]
Masers and lasers are relatively recent inventions which have rapidly found varied applications in many areas of science and industry. Professor Bertolotti's book describes the invention and development of both kinds of device, following their progress historically from 1916, when Einstein first proposed the concept of stimulated emission, until the present day. The fundamental theory of masers and lasers is given in order to complement this historical treatment. By means of extracts from the writings and recollections of scientists closely involved with masers and lasers, the author throws light on the way they were led to their inventions, and gives an idea of how they made use of one another's ideas and contributions. This book will appeal to anyone actively working with masers or lasers, or to physical scientists with an interest in scientific history. It will also be useful for anyone requiring an introduction to the fundamental physical theory involved, and extensive references to more specialised literature are included for those wishing to delve further into the subject.

69806 Physics of the Jovian magnetosphere. A.J.Dressler [Ed.]
Cambridge, England: Cambridge (1983), xv+544 pp. [0 521 24558 3]
Discusses the magnetic field and magnetosphere of Jupiter, the ionosphere, plasma characteristics, the low energy particle population, high-energy particles, the Io torus, radioemission from Jupiter, plasma waves and models of the magnetosphere.

69807 Laser processing and analysis of materials. W.W.Duley.
New York, USA: Plenum (1983), xiii+463 pp. [0 306 41067 2]
The rapid development of laser technology over the past dozen years has led to the availability of reliable, industrially rated laser sources with a wide variety of output characteristics. This, in turn, has resulted in new applications as the laser becomes a familiar processing and analytical tool. This text surveys recent developments made in the field of materials processing and analysis by means of lasers. Examples are drawn from chemical, metallurgical, and semiconductor processing, while the use of lasers as analytical tools in the laboratory and in industry is thoroughly examined. An introductory chapter provides a comprehensive overview of lasers and laser systems and their uses. Scientists, engineers, researchers, and students involved with laser applications will find this volume a valuable source of current information. (889 refs.)

01.30P Textbooks for undergraduates

69808 Similarities in physics. J.N.Shive, R.L.Weber.
Bristol, England: Adam Hilger (1982), xv+277 pp. [0 85274 540 0]
The purpose of the authors' book is to tie similar phenomena together, wherever they may appear, in mechanics, acoustics, optics, electricity, heat, or theoretical physics and to call one's attention to the similarities among them. The book may be so used by teachers who wish to present second-level physics from the analogy point of view. The authors' primary purpose has been to develop insight. Some presentation of new knowledge is undertaken, to be sure, but chiefly to broaden the insight. The book may therefore find its greatest usefulness as collateral reading material. It should be helpful, too, to students at all levels studying for comprehensive examinations.

69809 **Evolution of the Universe.** I.D.Novikov.
Cambridge, England: Cambridge (1983), xiv+176 pp. [0 521 24129 4]
Discusses the expanding Universe, relativistic cosmology, the hot Universe, formation and structure of the Universe and new and foreseen developments.

01.30R Surveys and tutorial papers; resource letters

A history of violin research ...... See Entry 69849

Light measurement many ways ...... See Entry 70099

Differential reflectometry and its application to the study of alloys, ordering, corrosion, and surface properties ...... See Entry 70108

Picosecond streak camera fluorometry. A review ...... See Entry 70117

Electron beam blanking systems ...... See Entry 70156

The structure of quarks and leptons ...... See Entry 70360

Heavy-ion atomic physics. The decay of the vacuum and intermediate molecules ...... See Entry 70581

Hyperfine interactions in isolated ions ...... See Entry 70582

Conditioning of low-heat-generating radioactive waste by incorporation in barrier-impregnated composite matrices—a review of experience in industrial-scale operation ...... See Entry 70669

The development and evaluation of SYNROC for high-level radioactive waste immobilization ...... See Entry 70681

In-beam gamma-ray spectroscopy with heavy ions ...... See Entry 70742

Probing nuclei far from stability with heavy ions ...... See Entry 70743

Spectroscopy, structure and bonding of high temperature metal halide vapor complexes ...... See Entry 70847

The hyperfine structure of akaline-earth monohalide radicals: new methods and new results 1980-1982 ...... See Entry 70924

What we do and do not know about electron impact excitation of atomic hydrogen ...... See Entry 71017

Fringe benefits: applications of holographic elements ...... See Entry 71088

A close look at optical plastics. II. Manufacturing and production tolerances ...... See Entry 71209

Progress in fiber test standards ...... See Entry 71236

Optical fibre sensor markets ...... See Entry 71251

Three-dimensional theory of inelastic stability (general questions) ...... See Entry 71417

Internal variables and the thermodynamics of macromolecule solutions ...... See Entry 71607

Generalized treatment of self-diffusivity for the gaseous and liquid states of fluids ...... See Entry 71677

Computer simulation of plasma turbulence in open systems ...... See Entry 71733

Aspects of the physics of laser-plasma interactions ...... See Entry 71744

Stability and confinement of spheromaks and field reversed configurations ...... See Entry 71780

Topics in reversed-field-pinch physics ...... See Entry 71782

The Tokamak ...... See Entry 71783

Experimental base of mirror-confinement physics ...... See Entry 71786

The reversed-field pinch ...... See Entry 71787

Computer modelling of amorphous magnetic materials ...... See Entry 71881

Convection in melt growth—theory and experiments ...... See Entry 71915

Nonstoichiometry of inorganic solids ...... See Entry 71955

Effect of irradiation on density of polymers ...... See Entry 72028

Phonons in amorphous materials ...... See Entry 72070

Melting, order, flows, mappings and chaos ...... See Entry 72087

Growth kinetic limitations during rapid solidification ...... See Entry 72088

Grain-boundary diffusion in metals ...... See Entry 72170

The spectroscopy of surface vibrations in ionic crystals by inelastic scattering of atoms ...... See Entry 72209

Dynamics of surface atoms and molecules under irradiation ...... See Entry 72227

Diataxy (graphoepitaxy) and other approaches to oriented crystallization on amorphous substrates ...... See Entry 72283

Localization and correlation effects in metals and semiconductors—experiment ...... See Entry 72341

Minority carrier recombination in heavily-doped silicon ...... See Entry 72415

Microscopic investigations of semiconductor interfaces ...... See Entry 72487

Optical detection of EPR using the luminescence emitted by crystal defects ...... See Entry 72714

SbSI and other ferroelectric $A^{V}B^{VI}C^{VII}$ materials ...... See Entry 72739

An overview of ion sputtering physics and practical implications ...... See Entry 72916

Temperature gradient zone melting ...... See Entry 72986

Recent trends in understanding dynamic compaction of powders ...... See Entry 73022

The modeling of rapidly solidified powders ...... See Entry 73023

Isostatic pressing technology for refractory materials ...... See Entry 73046

Rapid solidification of metastable materials ...... See Entry 73078

Some aspects of micro-alloying ...... See Entry 73092

Crack and cavity nucleation at interfaces during creep ...... See Entry 73145

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures ...... See Entry 73147

Residual and trace element effects on the high-temperature creep strength of austenitic stainless steels ...... See Entry 73148

Grain boundary sliding and stress concentration during creep ...... See Entry 73197

Report of a preliminary survey of NDT technolgoy with special reference to offshore structures ...... See Entry 73287

Arbitrary order functional sensitivity densities for reaction-diffusion systems ...... See Entry 73313

Radionuclide transport processes in terrestrial ecosystems ...... See Entry 73502

Electromechanical and physicochemical properties of connective tissue ...... See Entry 73624

Radiation biology: the conceptual and practical impact on radiation therapy ...... See Entry 73636

Prosthetic heart valve replacements ...... See Entry 73684

Test ban treaty verification with regional data—a review ...... See Entry 73730

Estimating the yield of underground nuclear explosions ...... See Entry 73731

The effect of attenuation on seismic body waves ...... See Entry 73732

Application of arrays in the detection, location, and identification of seismic events ...... See Entry 73733

Variations in seismicity as a fundamental tool in earthquake prediction ...... See Entry 73739

Surface plates and thermal plumes: separate scales of the mantle convective circulation ...... See Entry 73781

Gem materials, natural and artificial ...... See Entry 73793

Isotopic composition of the ocean-atmospheric system in the geologic past ...... See Entry 73916

A field guide to the binary stars ...... See Entry 74116

01.30T Bibliographies

69810 **Spectroscopy of molecular crystals. A bibliography for 1980.** E.F.Sheka, V.S.Makarova, T.A.Krivenko (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.197-276 (1983).
The bibliography is split into sections containing references on: books and reports of meetings; spectra of aromatic molecules in gaseous and condensed states; absorption and luminescence spectra of intermolecular complexes; spectra of pure molecular crystals; spectra of impurity and disordered molecular crystals; the exciton problem of molecular crystals; photoconductivity of molecular crystals including photoelectronic emission; effects of high exciton concentration in nonmetallic crystals; molecular crystal structure, thermodynamic data; and neutron spectroscopy of crystals. There is an author index. (1107 refs.)

69811 **Theory of partial coherence. A bibliography for the period 1976-1980.** K.Sing (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
Opt. Appl. (Poland), vol.12, no.3-4, p.489-98 (1982).
Most of the research detailed deals with the subjects of radiometry and partial coherence, directionality and spatial coherence and the influence of source structure in far-zone measurements. A particular emphasis was made on investigations dealing with the relationship between the spectral spatial coherence in the source plane and in the far-zone in terms of the generalized van Cittert-Zernike theorem and its inverse. (216 refs.)

Seismic event discrimination ...... See Entry 73729

Test ban treaty verification with regional data—a review ...... See Entry 73730

Estimating the yield of underground nuclear explosions ...... See Entry 73731

The effect of attenuation on seismic body waves ...... See Entry 73732

Application of arrays in the detection, location, and identification of seismic events ...... See Entry 73733

Variations in seismicity as a fundamental tool in earthquake prediction ...... See Entry 73739

01.40 EDUCATION

69812 **Teaching physics education in Iraq.** F.Esmael (Egyptian Antiquities Organization, Cairo, Egypt).
Phys. Teach. (USA), vol.21, no.4, p.224-9 (April 1983).
The author describes his experience teaching physics education at the College of Education at Mosul University in Iraq. He outlines the backgrounds of the students and describes the entry requirements and patterns of recruitment. He discusses the attitudes of the students, whose low opinion of the teaching profession and prediction for 'teaching by prompting', a style which involves little scope for learning by experiment, deduction or exploration. He concludes with a statement of his hopes and ideals for the teaching of physics education. (8 refs.)

01.50 EDUCATIONAL AIDS

69813 **Physicist's version of traveling salesman problem: statistical analysis.** R.S.Armour,Jr., J.A.Wheeler (Center for Theoretical Phys., Univ. of Texas, Austin, TX, USA).
Am. J. Phys. (USA), vol.51, no.5, p.405-6 (May 1983).
The authors report a statistical calculation of the average distance covered by the traveling salesman, per customer visited, in its dependence upon the width of the 'swaths' of landscape covered. They find a 'practical person's minimum' of (0.921) (density of points)$^{-1/2}$ for a swath width of (1.732) (density of points)$^{-1/2}$. The point of greatest physical interest is the foliation induced in the random pattern of cities to be visited by the 'regulating principle' of minimum distance. (4 refs.)

69814 **Potential difference and current in simple electric circuits: a study of students' concepts.** R.Cohen, B.Eylon, U.Ganiel (Dept. of Sci. Teaching, Weizmann Inst. of Sci., Rehovot, Israel).
Am. J. Phys. (USA), vol.51, no.5, p.407-12 (May 1983).
A study which was designed to identify students' concepts of simple electric circuits is reported. A diagnostic questionnaire was administered to a sample of 145 high school students and 21 physics teachers. The questionnaire included mainly qualitative questions which were designed to examine students' understanding of the functional relationships between the variables in an electric circuit. The main findings obtained from the analysis of the responses are current is the primary concept used by students, whereas potential difference is regarded as a consequence of current flow, and not as its cause. Consequently students often use $V=IR$ incorrectly. A battery is regarded as a source of constant current. The concepts of EMF and internal resistance are not well understood. Students have difficulties in analyzing the effect which a change in one component has on the rest of the circuit. This is probably due to the more general difficulty students have in dealing with a simultaneous change of several variables. (15 refs.)

69815 **Quantum logic.** C.G.Adler, J.F.Wirth (Dept. of Phys., East Carolina Univ., Greenville, NC, USA).
Am. J. Phys. (USA), vol.51, no.5, p.412-17 (May 1983).
A discussion of quantum logic is presented. An example, drawn from elementary quantum mechanics, is used to illustrate the failure of the classical distributive law which is quantum logic's most singular feature. Furthermore, an elaboration and explanation of an existing analog suitable for classroom demonstration is also presented. Finally, some remarks are made on the possible impact of quantum logic. (25 refs.)

69816 Elementary particle resonances from a semiclassical perspective. R.A.Arndt, L.D.Roper (Dept. of Phys., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Am. J. Phys. (USA), vol.51, no.5, p.418-20 (May 1983).
The motion of a particle in a short-range attractive potential, when treated classically but with quantized angular momentum l, can give rise to a finite series of particle 'resonances'. When this picture is applied to the π-NP_{33} resonance it is discovered that a physically reasonable Yukawa potential could produce the effect and that no resonances of higher l value would exist. (7 refs.)

69817 Rutherford scattering in two dimensions. G.Barton (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
Am. J. Phys. (USA), vol.51, no.5, p.420-2 (May 1983).
Parabolic coordinates allow Schrodinger's equation to be solved analytically for a particle confined to the xy plane and incident with velocity v on a potential C/r. In sharp contrast to the three-dimensional case, the cross section assumes its classical value only in the rationally foreseeable classical regime $|C|/\hbar v \gg 1$, but not otherwise; and in this low-velocity regime the enhancement factor (probability density at the origin) for an attractive potential tends to 2 (independently of the value of $|C|$), instead of diverging as in three dimensions like some inverse power of v. (8 refs.)

69818 Bikework. R.C.Nicklin (Dept. of Phys. & Astron., Appalachian State Univ., Boone, NC, USA).
Am. J. Phys. (USA), vol.51, no.5, p.423-9 (May 1983).
An exercise bicycle was fitted with a microswitch. The switch allows a small computer to time each revolution of the pedal crank. Constant work is done for each turn and so work versus time and instantaneous power versus time are readily calculated. A simple theory for the work as a function of time turns out to be sufficient. A comprehensive program, BIKEWORK, was written to enable a PET 4016 computer to be used for data gathering and analysis. In addition, a strategy for using computers in the laboratory emerged. The student benefits by having the computer do all the calculations necessary to critique each student's work. The results are available before the student leaves the lab. (8 refs.)

69819 A tidal force pendulum. O.Gron (Inst. of Phys., Univ. of Oslo, Blindern, Oslo, Norway).
Am. J. Phys. (USA), vol.51, no.5, p.429-31 (May 1983).
A tidal force pendulum is presented. Its period is calculated in three different ways: (a) by means of the spin equation, (b) using the Lagrangian formalism, and (c) by means of the equation for geodesic deviation. The period of the pendulum is independent of its length. It depends only upon the curvature of space-time at the position of the pendulum. (5 refs.)

69820 *F*-centers: advanced laboratory experiments as a 'research project'. J.F.Reichert (Dept. of Phys., State Univ. of New York at Buffalo, Amherst, NY, USA).
Am. J. Phys. (USA), vol.51, no.5, p.431-3 (May 1983).
A sophomore physics laboratory project is described which experimentally and theoretically studies by optical absorption bands of *F*-centers in alkali halide crystals using a variety of instrumental techniques. The student is challenged to develop a theoretical model to describe the optical absorption data. (5 refs.)

69821 The computer in lab—A/D and D/A conversion. R.C.Nicklin, B.Rafert (Dept. of Phys. & Astron., Appalachian State Univ., Boone, NC, USA).
Am. J. Phys. (USA), vol.51, no.5, p.434-9 (May 1983).
This article gives a brief introduction to analog-to-digital and digital-to-analog conversion. Circuit deails and programs are presented for using the AD7574 and AD558 converters with the KIM-1 computer. The resulting interface is easy to build, easy to use, and inexpensive. One application, which converts any triggered scope into a storage scope, is to capture and digitize a waveform and then display the waveform on an oscilloscope. (23 refs.)

69822 Numerical solutions of Van der Pol's equation. W.F.Drish,Jr. (Assoc. of American Railroads, Chicago, IL, USA), W.J.Wild.
Am. J. Phys. (USA), vol.51, no.5, p.439-45 (May 1983).
A qualitative picture of the solution to Van der Pol's equation, using rough phase plane plots, is obtained prior to using the Taylor and Modified Euler (TAME) method to obtain more exact phase plane plots. The character of the solution, which is a relaxation oscillation, is discussed. Finally, an application of Van der Pol's equation to a DC motor-generator hookup is given. (10 refs.)

69823 Report on using TIPS (teaching information processing system) in teaching physics and astronomy. N.O.Folland (Kansas State Univ., Manhattan, KS, USA), R.R.Marchini, C.R.Rhyner, M.Zeilik.
Am. J. Phys. (USA), vol.51, no.5, p.446-9 (May 1983).
A computer-managed instruction system, TIPS, has been used for over a decade in the teaching of diverse disciplines. This paper describes the recent use of TIPS in physics and astronomy courses at Kansas State University, Memphis State University, University of New Mexico, and University of Wisconsin-Green Bay. Student reactions to TIPS were largely positive, but the degree of success in improving student performance reported in many articles has not been observed. (7 refs.)

69824 Spinning objects on horizontal planes. L.A.Whitehead, F.L.Curzon (Dept. of Phys., Univ. of British Columbia, Vancouver, Canada).
Am. J. Phys. (USA), vol.51, no.5, p.449-52 (May 1983).
The authors present a simple theoretical analysis, of a common form of motion of a rotationally symmetric object (or symmetric top). The object, with its center of mass stationary, spins about its symmetry axis and rolls without slipping on a horizontal surface. The motion, which is referred to in the paper as 'wobbling', is long-lasting and stable and is exhibited by common objects (coins, bottles, plates, etc.) when they are spun on horizontal, flat surfaces. An apparatus is described for maintaining the 'wobbling' motion of a metal cylinder, which can be observed in slow motion by means of stroboscopic illumination. (1 ref.)

69825 The Si photodiode: an inexpensive though high-performing α detector. J.-C.Dousse, C.Rheme (Phys. Dept., Univ. of Fribourg, Fribourg, Switzerland).
Am. J. Phys. (USA), vol.51, no.5, p.452-5 (May 1983).
A common photodiode can be used as a good performing α detector. The energy response is quite linear. A good resolution and efficiency can be obtained. The main advantage, however, is the very low price. The useful area is limited to a few mm^2. A charge sensitive preamplifier has been especially designed. (4 refs.)

69826 Note on 'Spin-weighted spherical harmonics and electromagnetic multipole expansions'. R.B.S.Brooks, A.Purkis (Dept. of Maths., Bates Coll., Lewiston, ME, USA), M.D.Semon.
Am. J. Phys. (USA), vol.51, no.5, p.456-7 (May 1983).
In a recent article Joseph Scanio (see ibid., vol.45, p.173, 1977) gave a pedagogical introduction to multipole expansions of the electromagnetic field in terms of spin-weighted spherical harmonics. The spin-weighted spherical harmonics are a complete orthonormal set for functions of the spherical variables θ and ϕ. As Scanio demonstrates, expanding the radial, positive and negative helicity components of $(\mathbf{E}+i\mathbf{B})$ in their own terms results in a surprisingly simple and elegant formalism for electromagnetic scattering problems. While studying this material the authors found that certain questions arose which are answered in the literature, and which show the method to be more far-reaching and successful than they expected. The authors supplement Scanio's article by summarizing the questions they had, the answers they found and some references for further study. (12 refs.)

69827 The relation between the heat current and the phonon drift velocity. S.Simons (Dept. of Appl. Maths., Queen Mary Coll., London, England).
Am. J. Phys. (USA), vol.51, no.5, p.457-8 (May 1983).
In a perfect nonconducting crystal at low temperatures, the heat is transported by phonons whose only interactions are N processes which conserve the phonon wave number, $\mathbf{k}$. This gives rise to a stationary phonon distribution of the form $n(\mathbf{k})=\{\exp[(\hbar/\kappa T)(\omega-\mathbf{u}.\mathbf{k})]-1\}^{-1}$ (where ω is the phonon frequency), characterized by a drift velocity $\mathbf{u}$. It is known that if $u \ll v$, the phonon velocity, then for an isotropic medium the heat current $\mathbf{J}$ is parallel to $\mathbf{u}$. The author shows that this remains true for an anisotropic medium, the precise relationship being given by $\mathbf{J}=TS\mathbf{u}$, where T and S are, respectively, the temperature and entropy of the phonon assembly. (2 refs.)

69828 Maximizing the range of the shot put without calculus. S.K.Bose (Dept. of Phys., Simon Fraser Univ., Burnaby, Canada).
Am. J. Phys. (USA), vol.51, no.5, p.458-9 (May 1983).
Some time back, Lichtenberg and Wills (see ibid., vol.46, p.547, 1978) discussed the problem of finding the optimum angle at which a putter should release the shot in order to achieve maximum distance. Assuming that the shot is launched with velocity v_i from a height h over level ground in a uniform gravitational field, they express the range R as a function of the angle θ which the initial velocity vector makes with the horizontal and set $dR/d\theta$ equal to zero. Palffy-Muhoray and Balzarini (1982) pointed out that the problem could be solved without the use of calculus. Their method is short and elegant, but utilizes the idea of dot and cross products of vectors. Often the problem of projectile motion is encountered by students in a very introductory level physics course before they have had any exposure either to calculus or to the idea of products of vectors. The present author shows that this problem can be solved even with the use of a simple high school level of algebra, which most students taking an introductory physics course at an university are supposed to be familiar with. (2 refs.)

69829 A probabilistic derivation of the stability condition of the difference equation for the diffusion equation. B.Kaplan (Air Force Inst. of Technol., Wright-Patterson Air Force Base, OH, USA).
Am. J. Phys. (USA), vol.51, no.5, p.459-60 (May 1983).
A previous paper (see Gibbs et al. (1975)) demonstrated the solution to Laplace's and Poisson's equations by the random walk method. The probabilistic interpretation of difference equations can also be used to solve the diffusion equation by the Monte-Carlo method. The author shows that the probabilistic interpretation of the explicit finite difference equation for the diffusion equation can also be employed for pedagogical reasons to give a heuristic derivation of the stability criteria of the former. (7 refs.)

69830 Retarded square-well potential. J.Kapusta (Theory Div., CERN, Geneva, Switzerland).
Am. J. Phys. (USA), vol.51, no.5, p.460-1 (May 1983).
In an effort to gain some insight into the workings of interactions which are nonlocal in time, Blanchard (1981) noted that a mildly retarded oscillator potential behaves like an instantaneous logarithmic potential at large distances. The present author points out that particle motion in a retarded square-well potential is exactly soluble, and displays quite clearly the features one expects from interactions which are nonlocal in time. (2 refs.)

69831 An elementary development of mass-energy equivalence. D.J.Steck (Dept. of Phys., Saint John's Univ., Collegeville, MN, USA), F.Rioux.
Am. J. Phys. (USA), vol.51, no.5, p.461-2 (May 1983).
The authors describe a simple derivation of the mass-energy equivalence equation which they have not seen previously in the literature. The derivation is of the type which Einstein used and employs a 'thought experiment' in which an elementary photon emission event is examined by two sets of inertial observers. A comparison of the analyses of these observers brings the validity of the principle of momentum conservation into question. However since the conservation of momentum is the cornerstone of dynamics it is preserved at all costs. This is accomplished by allowing the concepts of the mass and energy to undergo redefinition. (2 refs.)

69832 Comment on 'The concept of temperature and its dependence on the laws of thermodynamics'. J.S.Thomsen (Dept. of Phys., Johns Hopkins Univ., Baltimore, MD, USA).
Am. J. Phys. (USA), vol.51, no.5, p.462 (May 1983).
Ehrlich (1981) has recently given an extended analysis of the concept of temperature, based on the laws of thermodynamics. In that paper he stressed the concept of temperature. The present author in 1962 published a restatement of the zeroth law of thermodynamics, namely there exists a scalar quantity called temperature, which is a property of all thermodynamic systems (in equilibrium states), such that temperature equality is a necessary and sufficient condition for thermal equilibrium. The terms 'scalar quantity' and 'necessary and sufficient' appear to establish a temperature order and overcome some of the gaps which Ehrlich finds in other treatments. Of course, the formulation achieves this by postulating something beyond the conventional form of the zeroth law, which then follows as a corollary. The above form also explicitly includes the requirement for equilibrium states. In Ehrlich's approach his domain D_1 is presumably restricted to systems which are either in equilibrium states or very close to equilibrium. There is one minor problem in Ehrlich's interesting parameter, i.e. the definition of heat reservoir. (2 refs.)

69833 Further support for a 'physical' interpretation of the primes. E.Staring, M.Staring (Dept. of Math., Inst. for Teachers Education, Sittard, Netherlands).
Am. J. Phys. (USA), vol.51, no.5, p.462-3 (May 1983).
In March 1982, H. Gutfreund and W.A. Little published a 'physicist's proof of Fermat's theorem of primes'. In their note they suggest an analogy between the primes and lack of symmetry of certain Ising-spin systems. This physical interpretation of primes can be further supported by a proof of Wilson's theorem on primes: if p is a prime, then $(p-1)!=-1$ (mod p). This proof will be presented here. (1 ref.)

69834 The rocket problem revisited. S.K.Bose (Dept. of Phys., Simon Fraser Univ., Burnaby, BC, Canada).
Am. J. Phys. (USA), vol.51, no.5, p.463-4 (May 1983).
The motion of a rocket in a force-free space is discussed in many introductory physics textbooks. It is shown that the final velocity achieved by the rocket is independent of how the fuel is released. The magnitude of the final velocity is

given by $V_f=u \ln (M_i/M_f)$, (1) where M_i and M_f are the initial and the final masses of the system, respectively, and μ is the velocity of escape of the fuel (measured in the frame of the rocket), opposite to the direction of the rocket motion. According to Eq. (1), the fuel can be expended slowly or rapidly without altering the final velocity. It is the author's experience that quite often students tend to generalize this result to the motion of any system with diminishing mass and moving in absence of external forces. In this regard, the author would point out that the independence of the final velocity from 'the way the mass is lost' is a consequence of the continuity of mass flow. It is this continuity that enables one to calculate the momentum change of the rocket for an infinitesimal time interval Δt and take the limit $\Delta t \to 0$, thus arriving at Eq. (1). In cases where such a limit does not exist, the final velocity does depend on how the mass is lost. (4 refs.)

69835 Polarized double-slit diffraction. W.C.Henneberger, R.N.Zitter (Dept. of Phys. & Astron., Southern Illinois Univ., Carbondale, IL, USA).
Am. J. Phys. (USA), vol.51, no.5, p.464-5 (May 1983).
A thought experiment in which one places a suitable detector behind a Young's double slit in an attempt to determine through which slit a photon has passed is discussed in many textbooks on modern physics and optics. The idea originated with Einstein, and Bohr argued that determination of the slit through which the photon has passed destroys the double-slit diffraction pattern, giving instead a superposition of single-slit patterns. The authors report a simple and alternative method of determining through which slit a photon has passed. They simply label the photons by their polarizations, e.g. by placing perpendicularly oriented Polaroid sheets behind the slits. Then once a photon has gone through either slit, its polarization indicates which slit it has gone through. (4 refs.)

69836 Comment on 'A simple model of the arms race' [and reply]. D.Schroeer (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA), L.I.Zane.
Am. J. Phys. (USA), vol.51, no.5, p.465-7 (May 1983).
In his recent article L.I. Zane (1982) presented a simple calculational model of the arms race. It is a mathematical description of the strategic nuclear relationship between two nuclear powers. Zane's model is readily understandable, but risks oversimplification. The present author briefly reviews the literature on this type of model, and points out how more complex versions may avoid some serious potential misunderstandings. Zane replies to this comment by thanking Schroeer for bringing other references of the arms model to his attention, but points out that simple models don't necessarily model reality better when they are made more complex though they certainly encourage one to think more seriously about the problem being modeled. (11 refs.)

69837 Comment on 'Photons and Doppler shifts in Einstein's derivation of mass energy'. R.H.Klein (Dept. of Phys., Cleveland State Univ., Cleveland, OH, USA).
Am. J. Phys. (USA), vol.51, no.5, p.467 (May 1983).
It has been noted, in a recent article by Jordan (1982), that Einstein's original argument for showing the equivalence of mass and energy is particularly accessible to students in a liberal arts science course intended for nonscience majors. The present author notes that an even simpler argument, requiring knowledge only of the nonrelativistic Doppler shift, can be found in a later paper by Einstein (1905). (3 refs.)

69838 Laser interference experiment using punchcard slits. M.J.Moloney (Div. of Phys., Rose-Hulman Inst. of Technol., Terre Haute, IN, USA).
Am. J. Phys. (USA), vol.51, no.5, p.468 (May 1983).
Describes a successful interference experiment that the author has run for a number of years using homemade slits from computer punchcards. A very recent modification of the experiment eliminates a comparator for determining slit widths and improves the precision in this experiment. (no refs.)

69839 Measurement of refractive index in transparent plates with a piece of paper and a laser source. S.Reich (Dept. of Plastics Res., Weizmann Inst. of Sci., Rehovot, Israel).
Am. J. Phys. (USA), vol.51, no.5, p.469 (May 1983).
A simple method for the measurement of the refractive index in transparent plates is demonstrated. A piece of filter paper or blotter is wetted with water and applied onto a glass plate. Laser beam is impinged perpendicularly to the plate and a bright ring is observed on the paper. Knowing the thickness of the plate d and the inner radius of the ring R, the refractive index of the plate is calculated. The geometrical optics of the system are shown. The wet paper serves both as a scatterer for the impinging laser light and as a scattering screen for the ring projection. All rays that enter the plate travel through until the condition for total internal reflection inside the plate is fulfilled. At this critical angle θ_c, and for larger angles the light is reflected and forms the ring pattern. (no refs.)

69840 Products of two vectors. Y.S.Jain (Dept. of Phys., North Eastern Hill Univ., Shillong, India).
Am. J. Phys. (USA), vol.51, no.5, p.470-1 (May 1983).
The dot and the cross products of a and b are defined, respectively, as $\mathrm{a.b}=ab \cos \theta$ (1), $\mathrm{a}\times\mathrm{b}=\hat{n}ab \sin \theta$ (2). Here all notations have their usual meanings. Authors of various texts on vector algebra differ on the basis for adopting these definitions. Resnick and Halliday (1976) believe that these operations are defined in this way because they prove useful in physics, otherwise one can have an alternative such as $\mathrm{a.b}=a^{1/3}b^{1/3} \tan \theta/2$ (3). Similar views are held by Arfken (1970). However, others do not state any reason explicitly; perhaps they agree with the argument (often given in the classroom) that Eqs. (1) and (2) simply define the two products and do not require any basis for this purpose. This note establishes that Eq. (1) and (2) are unique and could be formulated mathematically. For this purpose it examines the net product, a*b, defined as a quantity obtained through the normal process of algebraic multiplication of expressions defining the vectors. (5 refs.)

69841 Two-inductor electrostatic generator. A.Aresti (Gruppo Nazionale Struttura della Materia, Univ. di Cagliari, Italy), A.Delunas.
Am. J. Phys. (USA), vol.51, no.5, p.472-3 (May 1983).
A large number of induction electrostatic generators have been designed and built by many people in the last century. Amongst these, Wimshurst's machine is the best known because of its widespread use in educational institutions all over the world. However, the presence of two counter-rotating disks makes it difficult to explain it to students. On the other hand, the authors believe that the Kelvin water drop generator offers a model of induction charging which is simpler to explain. However, the Kelvin device does have an inconvenient problem, namely that if the potential difference builds up too much, before the electrical breakdown between the cans, as the electrical force approaches the size of the gravitational force, the drops are deflected which ends up wetting the apparatus. The generator then has to be dried with care before resuming operations. In order to eliminate the use of water and at the same time retain the advantages of the simpler model to explain to students, the authors have built a simple disk electrostatic generator. Even though this apparatus has much in common with several ancient machines and it is not as efficient as the Wimshurst's machine, it is a very useful device to use for teaching because of its simplicity. (no refs.)

69842 Simple demonstration of momentum change. D.H.Martin (Dept. of Phys., North Carolina State Univ., Raleigh, NC, USA).
Am. J. Phys. (USA), vol.51, no.5, p.474 (May 1983).
A perhaps not uncommon act of instructors when lecturing on momentum and impulse is to throw an eraser, a ball, or other handy small object against a wall or blackboard, and to discuss implications of the collision. As the wall is relatively very massive, a measurement of mass and an estimate of object velocities before and after collision allow the instructor to estimate the impulse. However, obtaining a good estimate of time of impact and average force of impact is more difficult. A 'quick-and-not-too-dirty' minimum set-up method of measuring the average force during impact is as follows: If a sponge rubber ball is used and is thrown against a solid (chalk-covered) blackboard, it will remove some chalk and leave a circular imprint, giving a measure of how much the ball compressed, or indented, during impact. Then by pressing the ball against a scale pan so as to produce the same impression, the variation of force with compression and the maximum force of interaction can be obtained. (no refs.)

69843 Chladni figures on a tympani head. V.J.Ostdiek, T.D.Brady (Phys. Dept., Benedictine Co., Atchison, KS, USA).
Am. J. Phys. (USA), vol.51, no.5, p.474 (May 1983).
In connection with a study of the acoustical behavior of tympani the authors produced Chladni patterns for several of the important tone producing modes of the head. The head was leveled and then sprinkled with red sand. An 8-in. speaker, driven by a 20-W amplifier, was suspended about 20 cm above the head and positioned over an antinode of a particular mode. The frequency of the sine wave input to the amplifier was slowly varied until a pattern appeared. Extreme care in tuning was required as the slightest asymmetry in tension in the head distorts or eliminates the figures. Chladni figures for the modes were produced on an old Ludwig 25-in. tympani (with plastic head) tuned to E_3 (165 Hz). (3 refs.)

69844 Laser beam deflection by thermal gradient. G.Spagna (Dept. of Phys., Rensselaer Polytech. Inst., Troy, NY, USA).
Am. J. Phys. (USA), vol.51, no.5, p.475 (May 1983).
The bending of light rays as they pass through regions of varying index of refraction is well known, and leads to such familiar phenomena as mirages, looming, and the shimmer around hot objects. Several demonstrations, invoking either thermal or chemical density gradients are readily available in the literature. The author presents one more, which takes advantage of the intense, collimated beam of an He-Ne laser to emphasize the deflection. The demonstration is compact, easy to set up, and requires no video system to be seen by large groups. (2 refs.)

69845 Toys in physics teaching: Cartesian diver. R.C.Turner (Dept. of Phys. & Astron., Clemson Univ., Clemson, SC, USA).
Am. J. Phys. (USA), vol.51, no.5, p.475-6 (May 1983).
The Cartesian diver has long been used as a scientist's 'toy' to demonstrate properties of fluids. Deschanel in his 1884 text on Natural Philosophy refers to the Cartesian diver as having been 'described in old treatises on physics'. Carhart and Chute refer to it as a 'hydrostatic toy' used to illustrate the Archimedes principle by Descartes (1596-1650). In spite of the longevity of use of the Cartesian diver, the scientific literature continues to contain discussions of modifications and sophistications of this relatively simple device, as well as rediscoveries of earlier ideas for its use. (15 refs.)

69846 Siting, constructing, and maintaining a deep underground science laboratory. R.R.Sharp,Jr. (Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.96, p.278-84 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
Experience from a recent site selection study has shown that the important considerations in siting a deep underground science facility are numerous, complicated, and most often based in economics. Even so, there are natural constraints on the maximum depth, size of openings, and construction techniques that can be attained or utilized at any particular site. In general, these are set by the local geothermal gradient, hydrologic regime, and properties of the rock mass or substance that are pertinent to geological, mining, and drilling engineering. At the same time, economics control the type of access, means of dewatering, and methods of sustaining the openings that are most feasible. If major faults can be avoided, sites offering acceptable temperature, a low water table, no outstanding aquifers or badly broken ground above the main openings, and strong, massive, largely impermeable rocks surrounding them at depth are best. Upon completion of a facility, the investment and safety of the occupants demand its rigorous maintenance. (25 refs.)

Cosmic ray physics underground: some puzzles ....See Entry 73997

01.55 GENERAL PHYSICS

69847 Intuitive physics. M.McCloskey.
Sci. Am. (USA), vol.248, no.4, p.114-22 (April 1983).
Although Newton's laws are well known, tests show many people believe moving objects behave otherwise. The subjects of the tests tend to follow a theory held in the three centuries before Newton. (no refs.)

Similarities in physics ....See Entry 69808

01.65 HISTORY OF SCIENCE

69848 Heat transfer in the last decade. R.H.Sabersky (Div. of Engng. & Appl. Sci., California Inst. of Technol., Pasadena, CA, USA).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.85-100 (March-April 1983).
In September of 1982, as part of the 7th International Heat Transfer Conference in Munich, a Panel Session was held with the title: 'Heat Transfer in the Last Decade—What did we accomplish? What remains to be done?' The session was in a way a follow up of panel sessions in Versailles (1970) and Tokyo (1974) in which attempts were made to outline the most pressing problems for future research in heat transfer. The session was well attended by representatives from all over the world. Those present were most generous in their active participation in the proceedings. In addition most of those who did address the panel confirmed their statements in writing and some who were not able to attend provided written comments. In the following an attempt will be made to summarize the views that were expressed and to convey a feeling for the spirit and the tenor of the meeting. This report therefore is of the nature of 'minutes of a meeting' and does not presume to represent a comprehensive or fully balanced account of all past achievements and future needs. (no refs.)

69849 A history of violin research. C.M.Hutchins (Catgut Acoustical Society Inc., Montclair, NJ, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1421-40 (May 1983).
From the probable origins of the violin in the early 16th century there is a long history of experimentation; first, the empirical development of the violin by the makers themselves over more than 200 years to its height of excellence in the late 17th and early 18th centuries; then the scientific investigations of its vibrational characteristics which have been done since the early 19th century. These have progressed in spurts of activity associated with technological innovations, particularly the developments of increasingly sensitive measuring equipment. This paper attempts to cover briefly the work of the early mathematicians as well as that of Savart, Helmholtz, and Rayleigh as related to the violin; then considers the research of the 20th century from the pre-electronic investigations of Raman, Miller, and Fuhr, through the spate of activity in violin research from 1930 to 1960 particularly in Germany, the USA, and Japan; and finally a brief overview of the many current developments associated with today's electronic and optical technologies, along with the concept of the violin as a musical instrument involving research in fields as widely separated as psychoacoustics, musical composition and performance, materials research, vibration analysis, and violin making. (193 refs.)

69850 The foundations of solid state physics. N.Mott.
Natl. Electron. Rev. (GB), vol.18, p.21-3 (1983).
The author discusses the application of the ideas of modern atomic physics to many problems, mainly in the fields of semiconductors and metals, photographic emulsion and corrosion. He has specialised in solids for 50 years since being appointed professor of theoretical physics at Bristol in 1933. He was Cavendish Professor of Physics, Cambridge University, from 1954 to 1971. He has been a Fellow of the Royal Society since 1936 and was awarded the Nobel Prize for Physics in 1977. (no refs.)

69851 Advances in the science and technology of crystals. T.Ogawa (Dept. of Phys., Gakushuin Univ., Tokyo, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1287-9 (Nov. 1982). In Japanese. [received: March 1983]
The history of the development of crystallography from 1669 to 1982 is recounted with emphasis on the major advances. (6 refs.) *M.O.*

Masers and lasers. An historical approach ....See Entry 69805

Historical regard to the origin of some partial places in nondestructive testing ....See Entry 73296

01.70 PHILOSOPHY OF SCIENCE

69852 The assessment of auxiliary hypotheses. J.Leplin (Univ. of North Carolina, Greensboro, NC, USA).
Br. J. Philos. Sci.(GB), vol.33, no.3, p.235-49 (Sept. 1982). [received: April 1983]
The following hypotheses have figured prominently in discussions of the legitimacy of recourse to auxiliary hypotheses to protect theories from falsification: The Contraction Hypothesis: Lorentz's postulation in 1892 of a contraction of solid bodies in the direction of their motion through the ether; used to block the derivation from the Lorentz electron theory of second order effects of the earth's motion so as to accommodate the Michelson-Morley null result. The Neutrino Hypothesis: Pauli's postulation in 1930 of a new particle accompanying the electron ejected from radioactive nuclei in beta decay; used to reconcile the continuous energy spectrum of beta decay with strict conservation of energy. The Hypothesis of a Trans-Uranian Planet: Adams's postulation in 1844 and Leverrier's in 1846 of a new planet to account for perturbations of Uranus. The Hypothesis of Intra-Mercurial Matter: Leverrier's postulation in 1856 of a new planet and subsequently of new planetoids or other perturbing matter to account for excessive precession of the perihelion of Mercury. In each case a developed, successful theory confronted by an empirical anomaly was modified so as to incorporate consistently a new hypothesis which removed the anomaly. Each new hypothesis immediately posed problems of independent testability. Scientists tend not to believe a problem has been solved, or solved adequately, until they believe that evidence for hypotheses which would provide a solution warrants belief in those hypotheses. Belief in the plausibility or likelihood of the hypotheses themselves is insufficient; what must be believed is that such belief is suitably confirmed. Otherwise the problem remains, although perhaps as one to approach through experimentation rather then further theorising. (12 refs.)

69853 Relational concepts of space and time. J.B.Barbour (Istituto di Fisica Teorica, Univ. di Pavia, Pavia, Italy).
Br. J. Philos. Sci.(GB), vol.33, no.3, p.251-74 (Sept. 1982). [received: April 1983]
According to Leibniz, space is not something substantial but is merely the order of coexisting things; similarly, time is merely the successive order of things. Historically, this view was opposed by Newton, with his concepts of absolute space and absolute time. It was clear to Newton—but perhaps not so clear to Leibniz—that a distinction between his absolute concepts and Leibniz's relational concepts becomes meaningful only at the level of dynamical theories of motion. Indeed, Weyl [1949], who inclines more to the Newtonian point of view, concedes that at the level of kinematics the relationist standpoint is irrefutable. The argument therefore hinges on the ability of the rival camps to formulate dynamical laws of motion. Here, the epistemological cogency of the relationist camp at the level of kinematics has been seriously weakened by its inability hitherto to construct genuinely relational theories of motion. The author attempts to identify the philosophical principles which are fundamental to the relationist case and show how they lead one, on the one hand, to epistemological doubts about the conventional conceptual framework of Newtonian and Einsteinian dynamics and, on the other, how they can be used positively in the construction of an alternative relationist framework. (21 refs.)

69854 The role of mathematics in physics. C.S.Sharma (Birkbeck Coll., Univ. of London, London, England).
Br. J. Philos. Sci.(GB), vol.33, no.3, p.275-86 (Sept. 1982). [received: April 1983]
The author's main contention is that it is imperative that physicists should modernise their knowledge of mathematics. In order to explain why this is so, it is necessary to examine what mathematics is and what its role in physics is. Few mathematicians or physicists are ever told what mathematics is—it is assumed to be what they learn in their mathematics courses. This is most unsatisfactory, particularly because students of modern mathematics are repeatedly told that in mathematics existence is synonymous with freedom from contradictions and in mathematics only those things or concepts exist which can be defined in a contradiction-free way. This is not to say that no one has ever attempted to define mathematics: on the contrary as is well-known there are tomes written on the definition and the philosophy of mathematics. It seems that there is no universal agreement even among the experts about the definition of mathematics and its role in other disciplines. (20 refs.)

01.75 SCIENCE AND SOCIETY

69855 Public perceptions of seismic hazards and critical facilities. D.S.Mileti (Colorado State Univ., Fort Collins, CO, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S13-18 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Public perceptions of seismic hazards rarely conform to common sense. Public perceptions are even more difficult to second guess when critical facilities are introduced into the equation. The public is typically biased in its perception of seismic hazards probabilities. These perceptions most characterize a public who do recognize that a generic earthquake risk exists; however, few members of that public personalize that risk and do much about it. Public perceptions of seismic hazards in reference to critical facilities follow suite with one exception. This exception is controversial critical facilities. On this front, the typical social and psychological factors and processes that form public seismic hazards perceptions are joined by several others. This paper reviews and summarizes the key factors that are the causes of public perceptions of seismic hazards in general, and in reference to noncontroversial and controversial critical facilities in particular. (16 refs.)

02.00 MATHEMATICAL METHODS IN PHYSICS

02.10 ALGEBRA, SET THEORY, AND GRAPH THEORY

Products of two vectors ....See Entry 69840

Stochastic linear maps and transition probability ....See Entry 69919

Comments about energies of parameter-dependent systems ......See Entry 69931

Scattering theory for quantum dynamical semigroups. II ....See Entry 70241

Lambert scattering from a hyperboloid of one sheet ....See Entry 71068

Set of orthogonal primary aberration coefficients ....See Entry 71076

Eigenvalue approach to magnetothermoelasticity ....See Entry 71386

A rational method for calculating mechanism maps ....See Entry 73097

02.20 GROUP THEORY

(for algebraic methods in quantum mechanics, see 03.65; for symmetries in elementary particle physics, see 11.30)

69856 On the unitary dual of $SO_0(2r, 2)$. E.Angelopoulos (Lab. de Phys. Math., Univ. de Dijon, Dijon, France).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.121-7 (March 1983).
An exhaustive description of the unitary dual of $\bar{SO}_0(2r, 2)$ is given by means of polynomials in the center of the enveloping algebra. The methods of proof are sketched. (7 refs.)

Hamiltonian structure of Sato's hierarchy of KP equations and a coadjoint orbit of a certain formal Lie group ....See Entry 69899

On the method of Symes for integrating systems of the Toda type ....See Entry 70015

Reduction and quantization for singular momentum mappings ....See Entry 70186

Kronecker products for compact semisimple Lie groups ....See Entry 70252

Scalar factors for non-canonical subgroup restriction of unitary group ....See Entry 70253

02.30 FUNCTION THEORY, ANALYSIS

69857 The quadratic bundle of a general form and the nonlinear evolution equations. I. Expansions over the 'squared' solutions: generalized Fourier transform. V.S.Gerdjikov, M.I.Ivanov.
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.13-26 (1983).
The completeness relation for the system of 'squared' solutions $\{\bar{\Psi}\}$ of the quadratic bundle $L(\lambda)$ of a general form is proved. The integro-differential operator Λ for which the elements of $\{\bar{\Psi}\}$ are eigen-and adjoint-functions is explicitly calculated. The interrelation between the set of potentials of $L(\lambda)$ and the set of scattering data is shown to have the meaning of a generalized Fourier transform over the system $\{\Psi\}$. Compact expressions for the trace identities of $L(\lambda)$ through the operator Λ are obtained. (35 refs.)

69858 Coupled nonlinear stochastic differential equations. G.Adomian (Center for Appl. Math., Univ. of Georgia, Athens, GA, USA), L.H.Sibul, R.Rach.
J. Math. Anal. & Appl. (USA), vol.92, no.2, p.427-34 (15 April 1983).
Systems of n coupled linear or nonlinear differential equations which may be deterministic or stochastic are solved by methods of the first author and his coworkers. Examples include two coupled Riccati equations, coupled linear equations, stochastic coupled equations with product terms, and n coupled stochastic differential equations. (7 refs.)

69859 Computation of Sturm-Liouville eigenvalues via Lagrangian interpolation. F.Calogero (Dipartimento di Fisica, Univ. di Roma, Rome, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.1, p.9-16 (7 May 1983).
A technique is presented for computing the eigenvalues λ_m of the regular Sturm-Liouville problem $d_2(x)\psi_m''(x)+d_1(x)\psi_m'(x)+d_0(x)\psi_m(x)=\lambda_m\psi_m(x)$, $\psi_m(b)=\psi_m(c)=0$. They are approximated by the ${}_m\psi_m(x)$, $\psi_m(b)=\psi_m(c)=0$. They are approximated by the eigenvalues $\lambda_m=\lambda_m-\delta\lambda_m$ of a $(n\times n)$-matrix A, given by a simple explicit formula in terms of the three functions $d_p(x)$ evaluated at n (arbitrary) points x_j, and of the distances of these points from the boundaries b and c. The rate of convergence as $n\rightarrow\infty$ is estimated to be quite fast, as suggested by the formula, applicable for equally spaced x_j's in the interval (b,c), $|\delta\lambda_m/\lambda_m|\sim(\pi m/2n)^{n-2}$. (3 refs.)

69860 Quasiconformal deformations of an arbitrary Riemann surface and variational formulas. F.Maitani (Coll. of Technol., Kyoto Tech. Univ., Kyoto, Japan).
Mem. Fac. Ind. Arts Kyoto Tech. Univ. Sci. & Technol. (Japan), vol.31, p.83-96 (Dec. 1982). [received: May 1983]
The purpose of this paper is to give variational formulas for Riemann's period matrices and certain kinds of meromorphic differentials on an arbitrary open Riemann surface which is deformed by quasiconformal homeomorphisms depending on a complex parameter. As the quasiconformal deformation the author considers Riemann surfaces with conformal structures decided by Beltrami differentials depending holomorphically on a complex parameter. For the sake of discussion on general open Riemann surfaces the author introduces a notion of behaviour spaces in the Hilbert space of first order differential forms. The mapping induced from a quasiconformal homeomorphism preserves the behaviour space. The variational formulas are valid for the class of meromorphic differentials restricted by the behaviour space. He shows examples that each element of the period matrix is holomorphic if branch points and boundary curves vary holomorphically on a converging surface of the complex plane. (14 refs.)

69861 Linearization of nonlinear differential-difference equations. F.W.Nijhoff, G.R.W.Quispel, H.W.Capel (Inst. Lorentz voor Theoretische Natuurkunde, Leiden, Netherlands).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.273-6 (9 May 1983).
A new linear integral equation is proposed, yielding an exact linearization of the integrable discrete versions of e.g. the nonlinear Schrodinger equation, the isotropic Heisenberg spin chain and the complex sine-Gordon equation. The Backlund transformation is discussed, as well as a discrete version of the anisotropic Heisenberg spin chain. (14 refs.)

A probabilistic derivation of the stability condition of the difference equation for the diffusion equation .... See Entry 69829

Note on linear systems derivable from a variational principle .. See Entry 69869

A note on the theory of conservative vibrations with path symmetry .... See Entry 69874

Sources of stress in two half-spaces .... See Entry 69879

Solving one class of paired integral equations in problems on diffraction theory .... See Entry 69897

On equations for wave interactions .... See Entry 69900

On one method of approximate solution of the Liouville equations .... See Entry 69909

Systems of equations of n-waves and nonlinear Schrodinger equations from the group-theoretical point of view .... See Entry 69934

A new integral equation for Fermi systems—the superposition approximation and its extension to calculation of the two-body correlation function .... See Entry 69976

Singular perturbation expansion for Markovian master equations .... See Entry 69982

The rate of absorption of Brownian particles by a sphere .... See Entry 69984

On the linearization of nonlinear Langevin-type stochastic differential equations .... See Entry 69986

Approximate Gaussian representation of evolution equations. I. Single degree of freedom nonlinear equations .... See Entry 69987

A method of approximation of invariant measures for maps on the unit interval .... See Entry 69991

Vectorial measures on vector lattices .... See Entry 70003

Reduction and quantization for singular momentum mappings .... See Entry 70186

Laplace transform method for off-shell scattering on nonlocal potentials .... See Entry 70509

One-dimensional acoustic wave propagation in a particulate suspension .... See Entry 71261

Determination of the flexural center of blade profiles by non-orthogonal coordinate difference method .... See Entry 71351

Hetenyi's elastic quarter space problem revisited .... See Entry 71357

Analysis of plates and shells by the semi-analytical and semi-discretizing method .... See Entry 71361

Deformation of flexible shells of revolution .... See Entry 71376

Solutions of the torsion problem for some kinds of bars with multiply connected section .... See Entry 71378

The torsion of a microelastic half-space by a flat annular rigid stamp .... See Entry 71379

Thermoelastic polynomials .... See Entry 71384

Solvability of boundary-value problems of the generalized theory of anisotropic shells .... See Entry 71391

Approximate representation of dissipation function in case of linear viscoelasticity with variable-amplitude vibrations .... See Entry 71459

An approximate method for the solution of some two-body contact problems with creep in the case of an unknown contact area .... See Entry 71492

Unsteady Couette flow and heat transfer in a dusty gas .... See Entry 71545

Potential function and problems of oscillations of an exponentially stratified liquid .... See Entry 71575

Integral-equation method for electric microfield distributions .. See Entry 71691

Generalization of Szebehely's equation .... See Entry 73977

Lagrange variational equations from Hori's method for canonical systems .... See Entry 73979

02.40 GEOMETRY, DIFFERENTIAL GEOMETRY, AND TOPOLOGY

(see also 04. Relativity and gravitation)

Hadron structure in terms of eight-dimensional space-time manifestation .... See Entry 70326

On the convection of a cusp in elastic stability .... See Entry 71416

02.50 PROBABILITY THEORY, STOCHASTIC PROCESSES, AND STATISTICS

(see also 05. Statistical physics)

Physicist's version of traveling salesman problem: statistical analysis .... See Entry 69813

The stochastic method for numerical simulations: higher order corrections .... See Entry 69862

Quasiclassical perturbation theory for quantum K-system .... See Entry 69921

Deterministic model of spin and statistics .... See Entry 69974

Optimal parameter identification for a linear system excited by Gaussian noise .... See Entry 69978

Local nondeterminism and local times of general stochastic processes .... See Entry 69979

Markov properties of R^2 processes .... See Entry 69980

Singular perturbation expansion for Markovian master equations .... See Entry 69982

Hierarchy of chaotic bands and periodicities embedded in them in a forced nonlinear oscillator .... See Entry 69983

On the linearization of nonlinear Langevin-type stochastic differential equations .... See Entry 69986

Approximate Gaussian representation of evolution equations. I. Single degree of freedom nonlinear equations .... See Entry 69987

Analytic study of power spectra of the tent maps near band-splitting transitions .... See Entry 69988

Statistical mechanics and population biology .... See Entry 69989

Phase transition in a four-dimensional random walk with application to medical statistics .... See Entry 69990

Remarks on existence of noise-induced long-time tail .... See Entry 69995

Microcanonical Monte Carlo simulation .... See Entry 69997

Numerical evaluation of path-integral solutions to Fokker-Planck equations .... See Entry 69999

Remarks on a stochastic quantization of scalar fields .... See Entry 70191

Statistical modeling of the creep characteristics of structural materials .... See Entry 73305

A two step linear statistical technique using leaps and bounds procedure for retrieval of geophysical parameters from microwave radiometric data .... See Entry 73919

A note on cross spectrum and coherence calculations .... See Entry 73944

02.60 NUMERICAL APPROXIMATION AND ANALYSIS

69862 The stochastic method for numerical simulations: higher order corrections. I.T.Drummond, S.Duane, R.R.Horgan (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.119-36 (16 May 1983).
The authors derive discrete versions of stochastic differential equations governing the evolution of some random variable $x(t)$ to arbitrary order in Δt, giving explicit formulae to second order. These are tested in the static case by examples where x takes values in the groups U(1) and SU(2). (2 refs.)

Computation of Sturm-Liouville eigenvalues via Lagrangian interpolation .... See Entry 69859

Approximation and numerical solution of contact problems with friction .... See Entry 69863

Investigation of numerical methods for solving the N-S equations .... See Entry 69889

High order accurate difference schemes for KdV-Burgers-RLW equations .... See Entry 69896

Error estimates for piecewise perturbation series solutions of the radial Schrodinger equations .... See Entry 69933

Solution of operator field equations by the method of finite elements .... See Entry 70017

A new fourth-order finite-difference method for solving discrete-ordinates slab transport equations .... See Entry 70022

Numerical method for the calculation of the light intensity distribution in the holographic image .... See Entry 71091

Reduced numerical integration in thermal transient finite element analysis .... See Entry 71330

Finite difference calculations of buoyant convection in an enclosure. I. The basic algorithm .... See Entry 71333

Determination of the flexural center of blade profiles by non-orthogonal coordinate difference method .... See Entry 71351

Dual methods for optimizing finite element flexural systems ... See Entry 71352

Dynamic response of frameworks by numerical Laplace transform .... See Entry 71353

The finite element method for thin-walled elastic curved beams .... See Entry 71362

Numerical anaysis of stressed state of thin shells with curvilinear holes .... See Entry 71390

Stress in an axisymmetric solid, taking account of plasticity .. See Entry 71408

On torsional buckling of thin walled I columns with variable cross-section .... See Entry 71415

Spurious reflection of elastic waves due to gradually changing finite element size .... See Entry 71439

An elastic-plastic solution for two-dimensional cracked body with finite element method .... See Entry 71462

A strange convergence property of the Lobatto-Chebyshev method for the numerical determination of stress intensity factors .... See Entry 71463

An analysis of coupled thermal-elastic contact problems with the finite element method .... See Entry 71489

Method of normal stress differences in photoelasticity .... See Entry 71506

Product integration methods for the nonlinear Basset equation .... See Entry 71523

Numerical study of incompressible flow about immersed elastic boundaries .... See Entry 71563

The two-dimensional oscillating airfoil: a new implementation of the galerkin method .... See Entry 71591

Shocks in gas pipelines .... See Entry 71600

The covariance least-squares algorithm for spectral estimation of processes of short data length .... See Entry 73938

02.70 COMPUTATIONAL TECHNIQUES

(for data handling and computation, see 06.50)

Spatial constrained mechanical system kinematic analysis employing a computer for generation of a mathematical model program OKAM .... See Entry 69864

Determining the temperatures in multilayer refractory walls on an analog computer .... See Entry 71338

FORTRAN computer program for inextensional bending of a doubly curved shell triangular element .... See Entry 71400

Unconditionally stable implicity-explicit algorithms for coupled thermal stress waves .... See Entry 71432

03.00 CLASSICAL AND QUANTUM PHYSICS; MECHANICS AND FIELDS

03.20 CLASSICAL MECHANICS OF DISCRETE SYSTEMS: GENERAL MATHEMATICAL ASPECTS

(for applied classical mechanics of discrete systems, see 46.10; for celestial mechanics, see 95.10)

69863 Approximation and numerical solution of contact problems with friction. J.Haslinger, M.Tvrdy.
Apl. Mat. (Czechoslovakia), vol.28, no.1, p.55-71 (1983).
There are many problems in which one deformable body comes into contact with another. Contact problems are nonclassical in the sense that they cannot be directly formulated as usual boundary value problems. The reason for this is the fact that neither the contact surface nor the distribution of contact forces are known a priori. It is well known that the mathematical formulation leads to variational inequalities. The aim of this paper is to study the approximation and the computation of contact problems between an elastic body and a rigid foundation, taking into account the influence of friction on the contact surface. The simplest model involving friction, namely that with 'a given friction', is analysed. The importance of this model is that it serves as an auxiliary problem, by means of which contact problems with friction obeying the classical Coulomb law can be approximated. The main attention is paid to the modification of Uzawa's algorithm, using specific features of the problem. (10 refs.)

69864 Spatial constrained mechanical system kinematic analysis employing a computer for generation of a mathematical model program OKAM. V.Brat, V.Pavlik, V.Stejskal (Tech. Univ., Karlovo, Praha, Czechoslovakia).
Acta Tech. CSAV (Czechoslovakia), vol.28, no.1, p.93-1087 (1983).
A kinematic analysis of spatial constrained mechanical systems (CMS), which employs a digital computer is presented. A theoretical basis of solution represents a basic matrix method. The OKAM program based upon this method enables the computer to assemble a mathematical model of the problem, i.e. a system of kinematic equations of motion of a concrete CMS, namely in a general (analytical) form. As input information, a simple symbolic equation expressed in basic matrices is employed. On substituting the respective input data values, the OKAM system can carry out a numeric solution to the system of equations with an incidental graphic output. Thus the paper represents a contribution to an automatic program generation for kinematic solution to concrete CMS. Two applications are presented. (7 refs.)

69865 Modal analysis for linear damped systems with many degrees of freedom. Fang Tong (Northwestern Polytech. Inst., China).
Acta Mech. Solida Sin. (China), no.3, p.312-16 (1981). In Chinese.
Discrete linear nonconservative systems with unsymmetrical matrices are considered. By making use of the properties of the adjoining matrices, the complex modal expansion formula for the transfer function matrix has been derived with ease. (6 refs.)

69866 Response of two-degree-of-freedom systems to multifrequency parametric excitations. A.H.Nayfeh (Dept. of Engng. Sci. & Mech., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
J. Sound & Vib. (GB), vol.88, no.1, p.1-10 (8 May 1983).
The method of multiple scales is used to analyze the response of two-degree-of-freedom systems to multifrequency parametric excitations. The equations describing the modulation of the amplitudes with time are derived for the case of four simultaneous resonances: main resonances of the two modes, combination resonance of the difference type, and combination resonance of the summed type. When only two simultaneous resonances exist, the modulation equations can be transformed into a system of four real first-order differential equations with constant coefficients whose solution depends on the eigenvalues of a four by four constant coefficient matrix. When three or more simultaneous resonances exist, the modulation equations cannot be made autonomous, in general, and hence one may not be able to solve them except numerically. (15 refs.)

69867 Dynamical behaviour of an oscillator sustained by an intermittent mechanism. F.Badrakhan (Coll. of Engng. & Petroleum, Kuwait Univ., Kuwait).
J. Sound & Vib. (GB), vol.88, no.1, p.27-36 (8 May 1983).
A new method for studying the dynamical behaviour of an oscillator sustained by an intermittent mechanism is presented. Graham escapement is considered as a typical model for such a mechanism. A new form given to the equation of motion permits the study of the natural frequency of the system, the establishment of a first integral in the case of a free motion and the analysis of effects of external harmonic or random perturbations. (10 refs.)

69868 Inertia in simple body models. J.Lubliner (Dept. of Civil Engng., Univ. of California, Berkeley, CA, USA).
Mech. Res. Commun. (GB), vol.10, no.1, p.1-7 (Jan.-Feb. 1983).
Introduces inertia as an element of an abstract simple body model in such a way that all the classical inertial quantities (mass, linear and angular momentum, kinetic energy) are derived from it. The classical monopolar inertia is identified as a special case, and it is shown that it is the only possible inertia when the only force systems allowed are measured. The more general inertia is then used to derive the inertial force system. An application is made to the laws of motion. (4 refs.)

69869 Note on linear systems derivable from a variational principle. W.Sarlet (Inst. voor Theoretische Mechanica, Rijksuniv. Gent, Gent, Belgium).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.72-5 (18 April 1983).
This paper is a complementation of a previous one (see Int. J. Eng. Sci., vol.20, p.55, 1982) in which the author studied the problem of converting general linear second-order equations into Euler-Lagrange equations through multiplication by a time-dependent matrix. The present paper discusses the possibility of having multipliers depending on coordinates and velocities too. (8 refs.)

69870 Superintegrability of the Calogero-Moser system. S.Wojciechowski (Inst. of Theoretical Phys., Univ. of Warsaw, Warsaw, Poland).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.279-81 (9 May 1983).
It is shown here that the classical Calogero-Moser system of N particles and its higher flows are superintegrable in the sense that they have $2N-1$ global, functionally independent, single-valued integrals of motion not depending explicitly on time. (5 refs.)

69871 Quasiinvariant gyroscopic systems. S.P.Sosnitskii (Inst. of Math., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.657-60 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.98-101 (July 1982). [received: March 1983] (3 refs.)

69872 Rapid rotation of a heavy gyrostat about a fixed point in a resisting medium. L.D.Akulenko, D.D.Leshchenko (Inst. of the Problems of Mech., Acad. of Sci., Moscow, USSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.660-5 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.102-7 (July 1982). [received: March 1983]
Considers an asymmetric heavy rigid body with a spherical cavity filled with a high-viscosity liquid rotating rapidly about a fixed point in a weakly resisting medium. The authors call motions rapid when the moment of the applied forces about the fixed point is small in comparison with the instantaneous value of the kinetic energy of rotation. (14 refs.)

69873 Optimum reorientation of elastic system with constraints on angular velocity. A.E.Zakrzhevskii (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.666-70 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.108-13 (July 1982). [received: March 1983]
Reorientation of a free solid body in inertial space is one of the modes of programmable motion of interest for technical applications. Such a maneuver can, for instance, be effected by a single rotation about an Euler axis stationary in inertial space and in a system of coordinates tied to the body. In this study the author considers the problem of determining the optimum programmable law of varying the angular displacement of a solid body with attached elastic elements about the axis of rotation, to ensure the necessary quality of dynamic processes in the elastic elements under constraints on the angular velocity of rotation in the case of uniaxial orientation. (5 refs.)

69874 A note on the theory of conservative vibrations with path symmetry. R.Frischbier (Martin-Luther-Univ., Halle, Germany).
Z. Angew. Math. & Mech. (Germany), vol.63, no.3, p.212-3 (1983). In German.
Presents an approximation method for the solution of functions like $\ddot{s}(t)=-h(s)$, where $t_0=4\int_{s0}^{s1}[H(s_1)-H(s)]^{-1/2}\,ds$ and $H(s)=2\int_0^s h(s)ds$. An exact solution cannot be found for the general case but an approximation can be obtained in a simple manner. The solution is applied to Hertz's impact equation and to the mathematical pendulum. (3 refs.) *J.S.*

A tidal force pendulum .... See Entry 69819

Numerical solutions of Van der Pol's equation .... See Entry 69822

Spinning objects on horizontal planes .... See Entry 69824

The rocket problem revisited .... See Entry 69834

Simple demonstration of momentum change .... See Entry 69842

The formalism of contact for classical mechanics and relativity .... See Entry 69875

On the bifurcations of a certain family of periodic orbits .... See Entry 73970

The reduction to the rotation for planar perturbed Keplerian systems .... See Entry 73972

Solution of equations of problem of motion of a heavy rigid body about a fixed point in the Kowalevskaya's case using θ-function .... See Entry 73973

The rotation number of bounded orbits in a central field .... See Entry 73974

Stability criteria in many-body systems. V. On the totality of possible hierarchical general four-body systems .... See Entry 73975

On the double averaged three-body problem .... See Entry 73976

Impossibility of the capture of retrograde satellites in the restricted three-body problem .... See Entry 73980

Calculation of ephemerides for libration points .... See Entry 73981

About the non-existence of additional analytical integral in the problem of a satellite's motion under the gravitational attraction of a triaxial rigid body .... See Entry 74005

03.30 SPECIAL RELATIVITY

69875 The formalism of contact for classical mechanics and relativity. J.Bryant (Lab. de Mecanique Theorique, Univ. de Besancon, Besancon, France).
Ann. Inst. Henri Poincare Sect. A (France), vol.38, no.2, p.121-52 (1983). In French.
A more general formulation of Hamiltonian mechanics can be given using the notion of exact canonical manifold introduced by Lichnerowicz. A traditional problem, the N-Body problem, is considered from this viewpoint. Furthermore, relativistic mechanics can be formulated in this framework. (9 refs.)

69876 Is the unidirectional speed of light observable?. Y.Z.Zhang (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.225 (2 May 1983).
It is pointed out the unidirectional velocity of light is not directly observable. The proposed method by Aspden (see ibid., vol.92, p.165, 1982) cannot be used to measure the first-order speed of light anisotropy. (5 refs.)

69877 A proposed observational test of six-dimensional relativity. E.A.B.Cole (Dept. of Appl. Math. Studies, Univ. of Leeds, Leeds, England).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.282-4 (9 May 1983).
Using equations of motion for a charged particle acted on by the new electromagnetic fields allowed in six-dimensional relativity, it is shown how much a particle moving in the field of a central charge can have a space trajectory which the standard four-dimensional theory does not allow. (6 refs.)

An elementary development of mass-energy equivalence ....See Entry 69831

Comment on 'Photons and Doppler shifts in Einstein's derivation of mass energy' ....See Entry 69837

Relativistic effect on atomic clocks ....See Entry 70027

03.40 CLASSICAL MECHANICS OF CONTINUOUS MEDIA: GENERAL MATHEMATICAL ASPECTS

A thermodynamic development of generalized Fourier and Ohm conduction laws for anisotropic materials ....See Entry 72365

03.40D Mathematical theory of elasticity

(see also 46.20 Continuum mechanics, and 46.30 Mechanics of solids)

69878 Plane dynamic problems for elastic incompressible bodies with initial stresses. S.Iu.Babich, A.N.Guz.
Appl. Math. & Mech. (USA), vol.46, no.2, p.197-204 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.263-71 (1982).
The plane dynamic problems are considered when the original dynamic problems admit reduction to steady state problems in a system of coordinates in rectilinear motion at constant velocity. The investigation is carried out using relations of the linearized theory of elasticity. Complex potentials are introduced for equal and unequal roots of the controlling equation with potentials of arbitrary form. A method of obtaining exact solutions using complex potentials is indicated in the case of bodies with initial stresses. Values of complex parameters are presented for bodies with elastic potential of specific form. (27 refs.)

69879 Sources of stress in two half-spaces. V.P.Kochurov.
Appl. Math. & Mech. (USA), vol.46, no.2, p.205-9 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.272-7 (1982).
Solutions are given for two versions of the problem of displacements from a source of stresses (the domain of displacement or stress field peculiarities) in two isotropic linearly elastic half-spaces, on whose plane boundaries conditions relating the boundary values of the derivatives of the displacements of different orders are satisfied. The method of solution proposed permits the displacement in the half-spaces to be expressed in terms of indefinite integrals of the gradients of the displacements produced by the stress source in an unbounded homogeneous medium. (10 refs.)

69880 Optimality conditions in axisymmetric problems of elasticity theory. S.B.Vigdergauz.
Appl. Math. & Mech. (USA), vol.46, no.2, p.210-13 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.278-82 (1982).
The result of the optimality of equi-stressed contours in a loaded plane is extended to the case of a space with cavities that are axisymmetric. Boundary conditions are found to determine the shape of the optimal cavities, the inverse axisymmetric problem of elasticity theory, and its analytic solution is obtained in the case of a single cavity. (8 refs.)

69881 On inequalities of Korn, Friedrichs and Babuska-Aziz. C.O.Horgan (Michigan State Univ., East Lansing, MI, USA), L.E.Payne.
Arch. Ration. Mech. & Anal. (Germany), vol.82, no.2, p.165-79 (1983).
Korn's inequalities for integrals of quadratic functionals subject to certain side conditions have played a fundamental role in the development of elasticity theory. The Korn inequalities are essential in establishing coerciveness of the differential operators of linear elastostatics and thus form the basis for existence results in that theory. Among other areas in elasticity where consideration of Korn's inequalities arise the authors cite, for example, fundamental studies on the mathematical foundations of finite elements, stability theory and qualitative analyses of solution behavior, such as those involved in the investigation of Saint-Venant's principle. In the latter two areas of application in particular, information on the optimal constants appearing in the inequalities, the Korn constants, is of importance. Thus several investigations have been concerned with evaluating the Korn constants for specific domains and with obtaining bounds for these constants. The authors' purpose is to draw attention to an equivalence, for two-dimensional simply-connected domains, between Korn's inequality (in the second case) and two other inequalities for quadratic functionals which have received comparatively little attention in the literature. (24 refs.)

69882 A transformation model of generalized two-dimensional problems of linear elasticity in nonhomogeneous anisotropic medium. Jin Fu-sheng (Changjiang River Shipping Sci. Res. Inst., China).
Acta Mech. Solida Sin. (China), no.3, p.374-9 (1981). In Chinese. (2 refs.)

69883 Geometrically nonlinear formulation for the axi-symmetric transition finite elements. K.S.Surana (McDonnell Douglas Automation Co., Saint Louis, MO, USA).
Comput. & Struct. (GB), vol.17, no.2, p.243-55 (1983).
Presents a geometrically nonlinear formulation for the axi-symmetric transition finite elements using total Lagrangian approach. The basic element is formulated using properties of the axi-symmetric solids and the axi-symmetric shells. A novel feature of the formulation is that the restriction on the magnitude of the rotations for the shell nodes of the transition element is eliminated. This is accomplished by retaining true nonlinear functions of nodal rotations in the definition of the element displacement field. Such transition elements are essential for geometrically nonlinear applications requiring both axi-symmetric solids and the axi-symmetric shells. They ensure proper connection of the axi-symmetric solid portion of the structure to the shell-like portion of the structure. It is shown that the selection of different stress and strain components at the integration points does not effect the overall linear response of the element. However, in the geometrically nonlinear formulation, it is necessary to select appropriate components of the stresses and the strains at the integration point for accurate and converging element behavior. Numerical examples are presented to demonstrate such characteristics of the transition elements. (15 refs.)

69884 An approximate nonlinear design procedure for partially prestressed concrete beams. A.E.Naaman (Dept. of Materials Engng., Univ. of Illinois, Chicago, IL, USA).
Comput. & Struct. (GB), vol.17, no.2, p.287-99 (1983).
The theoretical basis and the main results of an approximate nonlinear design procedure, which attempts to predict the behavior at ultimate of prestressed and partially prestressed concrete member, is presented. Difficulties encountered in simulating the actual behavior of concrete and steel are discussed. Particular emphasis is put on comparing the various available stress-strain relationships for prestressing steels, and observed variability in their actual properties. Recommended equations and corresponding coefficients are given. Typical results showing the influence on ultimate behavior of major variables such as the type and amount of prestressing steel, the amount of nonprestressed tensile and compressive reinforcement, and the ultimate concrete compressive strain are presented and compared with code derived results. They help point out where the code recommendations, if used, may lead to an unsafe design and what modifications may be needed to make them more representative of observed trends. (27 refs.)

69885 Structural analysis by a combined finite element-transfer matrix method. M.Ohga (Dept. of Civil Engng., Ehime Univ., Matsuyama, Japan), T.Shigematsu, T.Hara.
Comput. & Struct. (GB), vol.17, no.3, p.321-6 (1983).
The combined finite element-transfer matrix method has the advantage of reducing the size of a matrix to less than that obtained by the ordinary finite element method. The analytical procedure in this method for bending and buckling problems are described, and techniques for treating the structure with intermediate conditions are proposed. Various numerical examples of these problems are shown to demonstrate the efficiency and accuracy of this method. The results from these examples agree well with those obtained by the finite element method and others. (10 refs.)

69886 Operator split methods in the numerical solution of the finite deformation elastoplastic dynamic problem. P.M.Pinsky (Div. of Engng., Brown Univ., Providence, RI, USA), M.Ortiz, R.L.Taylor.
Comput. & Struct. (GB), vol.17, no.3, p.345-59 (1983).
The spatial formulation of the elastoplastic problem for finite deformations is considered. A thermodynamic argument leads to an additive decomposition of the spatial rate of deformation tensor and allows an operator split of the evolutionary equations of the problem into 'elastic' and 'plastic' parts. This operator split is taken as the basis for the definition of a global product algorithm. In the context of finite element discretization the product algorithm entails, for every time step, the solution of a nonlinear elastodynamic problem followed by the application of plastic algorithms that operate on the stresses and internal variables at the integration points and bring in the plastic constitutive equations. Suitable plastic algorithms are discussed for the cases of perfect and hardening plasticity and viscoplasticity. This formalism does not depend on any notion of smoothness of the yield surface and is applicable to arbitrary convex elastic regions, with or without corners. The stability properties of the global product algorithm are identical to those of the algorithm used for the integration of the nonlinear elastodynamic problem. Numerical examples illustrate the accuracy of the method. (34 refs.)

69887 Existence of temperature and entropy of a continuous medium and its consequences on the elastic part of the stress tensor. H.Gouin, F.Gouin (Faculte des Sci. et Techniques de Saint-Jerome, Marseille, France).
Mech. Res. Commun. (GB), vol.10, no.1, p.21-6 (Jan.-Feb. 1983).
It is now a classical point of view to extend thermodynamics into continuum mechanics. The usual mathematical methods lead to the balance equations and the Clausius-Duhem inequality. The authors envisage a thermomechanical process as described by the motion of the continuous medium, the stress tensor, the specified internal energy, the body force, the heat flux vector and the heat supply. The two conservation laws: the law of balance of linear momentum and the law of balance of energy (the first law of thermodynamics) are satisfied. (19 refs.)

69888 On elastoplastic analysis by boundary elements. G.Maier (Dept. of Structural Engng., Tech. Univ., Milan, Italy).
Mech. Res. Commun. (GB), vol.10, no.1, p.45-52 (Jan.-Feb. 1983).
The discretized incremental elastoplastic BV problem is formulated in terms of plastic multiplier and yield function rates only. By means of computationally inexpensive 'consistent' modelling over cells, the matrix which transforms plastic strains into stresses is shown to become symmetric and positive seminegative up to the discretization errors. After the symmetrization of this matrix, two dual extremum theorems are established for the elastoplastic rate solution. (8 refs.)

Approximation and numerical solution of contact problems with friction ....See Entry 69863

Field redistribution in finite elements—a mathematical alternative to reduced integration ....See Entry 71364

Reflections on the computational approximation of elastic incompressibility ....See Entry 71365

Orthotropic cylindrical shells under line load along a generator ....See Entry 71367

Torsion of tube structures: planar formulation ....See Entry 71368

Optimization for structures of discrete-size elements ....See Entry 71369

A study of shear factors in reduced-selective integration Mindlin beam elements ....See Entry 71370

A nonlinear, semi-analytical finite element analysis for nearly axisymmetric solids ....See Entry 71372

A simple selectivity integrated torsion—flexure coupled tapered beam element with transverse shear deformation ....See Entry 71373

A unified approach for the analysis of bridges, plates and axisymmetric shells using the linear Mindlin strip element ....See Entry 71374

A comparison of the linear, quadratic and cubic Mindling strip elements for the analysis of thick and thin plates ....See Entry 71375

Numerical anaysis of stressed state of thin shells with curvilinear holes ....See Entry 71390

Solvability of boundary-value problems of the generalized theory of anisotropic shells ....See Entry 71391

Isoparametric finite difference energy method for plate bending problems ....See Entry 71394

A reinvestigation of post-buckling behaviour of elastic circular plates using a simple finite element formulation ....See Entry 71413

On the convection of a cusp in elastic stability ....See Entry 71416

Doubly asymptotic approximations as non-reflecting boundaries in fluid-structure interaction problems ....See Entry 71428

A geometrically nonlinear shell finite element for tire vibration analysis ....See Entry 71429

Unconditionally stable implicity-explicit algorithms for coupled thermal stress waves ....See Entry 71432

Estimation of the fundamental frequencies of shallow shells by a finite element-isodeflection contour method ....See Entry 71433

A strange convergence property of the Lobatto-Chebyshev method for the numerical determination of stress intensity factors ....See Entry 71463

Quarter-point elements for curved crack fronts ....See Entry 71464

A variable power singular element for analysis of fracture mechanics problems ....See Entry 71466

A finite surface element model for two concentric nearly circular rings in partial contact ....See Entry 71490

Strain hardening representation for implicit quasistatic elasto-viscoplastic algorithms ....See Entry 73104

03.40G Fluid dynamics: general mathematical aspects

(see also 47. Fluid dynamics)

69889 **Investigation of numerical methods for solving the N-S equations.** Ma Yau-wen.
Math. Numer. Sin. (China), vol.5, no.1, p.79-89 (1983). In Chinese.
Two difference schemes are proposed for reducing the oscillations near the shock in solving the Navier-Stokes equations. One is a scheme using a time increment parameter, the other is a one-step difference scheme with an adjustable parameter. Numerical experiments show that the schemes proposed are useful. (12 refs.)

69890 **Classification of difference schemes of gas dynamics by the method of differential approximation. I. One-dimensional case.** N.N.Yanenko, Z.I.Fedotova, L.A.Tusheva, Yu.I.Shokin (Inst. for Pure & Appl. Mech., Acad. of Sci., Novosibirsk, USSR).
Comput. & Fluids (GB), vol.11, no.3, p.187-206 (1983).
One-dimensional difference schemes are described for 'across'-computations of ideal gas dynamics problems. Their classification in definite properties is given. This classification is based on the method of differential approximation, i.e. some characteristics of difference schemes are to be defined with the help of appropriate characteristics of the differential approximation. The most important properties of the difference schemes considered are represented in special tables. (38 refs.)

69891 **On two upwind finite-difference schemes for hyperbolic equations in non-conservative form.** B.Gabutti (Istituto di Calcoli Numerici, Univ. Degli Studi di Torino, Torino, Italy).
Comput. & Fluids (GB), vol.11, no.3, p.207-30 (1983).
Several finite difference-schemes for approximating solutions of initial value problems associated with systems of linear hyperbolic differential equations are considered. Common features of the schemes is the approximation of the space-like derivatives according to the behavior of the characteristics (upwind schemes for hyperbolic equations). The analysis of standard properties (consistency, stability, convergence, dissipativity, phase error) of finite difference schemes is performed. In addition, extensions of certain upwind schemes to nonlinear equations, extensions to several space-like dimensions by splitting methods and two implicit finite difference schemes are considered. (30 refs.)

69892 **On the construction of *K*-consistent difference schemes of gas dynamics.** E.V.Vorozhtsov, N.N.Yanenko (Inst. of Theoretical & Appl. Mech., Acad. of Sci., Novosibirsk, USSR).
Comput. & Fluids (GB), vol.11, no.3, p.231-49 (1983).
Previously it was found by the present authors that the use of non-classical equations of state in gas dynamic computations by Eulerian difference schemes may give rise to spurious oscillations of the numerical solution in the vicinity of contact discontinuities. Two accurate methods for elimination of these oscillations are now proposed. One of these methods is based on a new definition of the *K*-consistency of difference schemes. Another method makes use of difference approximations of an unsteady equation for pressure which is a well-known consequence of the Euler equations. The effectiveness of the methods proposed is illustrated by computational results. (14 refs.)

69893 **An implicit predictor-corrector method for real space Chebyshev pseudospectral integration of parabolic equations.** R.S.Hirsh, T.D.Taylor, M.M.Nadworny (Appl. Phys. Lab., John Hopkins Univ., Laurel, MD, USA).
Comput. & Fluids (GB), vol.11, no.3, p.251-4 (1983).
Severe restrictions are imposed by the use of Chebyshev pseudospectral methods for the solution of parabolic problems if standard time integration techniques are utilized. For example, explicit time differencing methods give a stability restriction of $\Delta t=0(1/N^4)$ where Δt is the time step and N is the number of Chebyshev interpolation points. This is a much more restrictive requirement on Δt than that of standard finite difference methods which can be expressed as $\Delta t=0(1/N^2)$. However, for parabolic problems, time steps much larger than the characteristic diffusive time are desirable, and hence, implicit methods are essential. The authors propose a finite difference predictor/spectral corrector (FDP/SC) iteration scheme which allows time steps not restricted by the explicit diffusive stability limit. (8 refs.)

69894 **Hydrodynamic boundary conditions from kinetic theory.** V.Protopopescu, T.Keyes (Sterling Chem. Lab., Yale Univ., New Haven, CT, USA).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.139-42 (25 April 1983).
A simple tagged particle kinetic equation is studied in the presence of a wall, where the boundary conditions may be reflecting, absorbing, or a mixture thereof. A diffusion equation is derived from the kinetic equation via the scaling, $t \rightarrow t/\epsilon^2$, $x \rightarrow x/\epsilon, \epsilon \rightarrow 0$. To $O(\epsilon^0)$, the boundary conditions on the diffusion equation are found to be Neumann for pure reflection and Dirichlet if any absorption is present. To $O(\epsilon)$, a mixed or 'radiative' boundary condition is obtained, which may be interpreted in terms of a Dirichlet condition at an extrapolated length, $O(\epsilon)$, inside the wall. (12 refs.)

Product integration methods for the nonlinear Basset equation ....See Entry 71523

Potential function and problems of oscillations of an exponentially stratified liquid ....See Entry 71575

Normal oscillations of an ideal compressible liquid in rotating elastic vessels ....See Entry 71576

The two-dimensional oscillating airfoil: a new implementation of the galerkin method ....See Entry 71591

03.40K Waves and wave propagation: general mathematical aspects

(see also 46.30M Mechanical and elastic waves, 43.20 General linear acoustics)

69895 **Analysis of some Korteweg-de Vries systems.** A.Ya.Spasov, P.G.Georgiev (Inst. of Electronics, Bulgarian Acad. of Sci., Sofia, Bulgaria).
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.36-41 (1983).
Waves in a system described by the second Kakutani-KdV equation have been considered. The results obtained are in agreement with Green's law. Nonlinear wave interaction has also been considered. Solitons have been treated as an example. Approximate analytical expressions have been obtained. (14 refs.)

69896 **High order accurate difference schemes for KdV-Burgers-RLW equations.** Wu Hua-mo (Computing Center, Acad. Sinica, China), Guo Ben-yu.
Math. Numer. Sin. (China), vol.5, no.1, p.90-8 (1983). In Chinese.
A fourth order accurate difference scheme for the KdV-Burgers-RLW equations is proposed. The proof of stability and convergence, and error estimation of this scheme is given. The new nonelastic character of 2-soliton collision for the RLW equations is illustrated. (17 refs.)

69897 **Solving one class of paired integral equations in problems on diffraction theory.** T.M.Akhmedov, E.I.Veliev.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.3, p.54-7 (1983). In Ukrainian.
A method is suggested for solving paired integral equations with infinite limits of integration which appear in various diffraction theory problems. After a partial inversion of an integral operator the initial paired equations are reduced to solving linear algebraic second-kind Fredholm equations solvable with any preset accuracy. (4 refs.)

69898 **A kink-antikink soliton propagating with varying velocity.** P.C.W.Fung, C.Au (Phys. Dept., Univ. of Hong Kong, Hong Kong).
J. Phys. A (GB), vol.16, no.8, p.1611-21 (1 June 1983).
Using their previous KdV solution (1982), the authors apply a Backlund transformation to obtain new sets of solutions to another nonlinear equation $y_t+y_{xxx}-6y^2y_x+6y_x=0$ based on theorems deduced recently. The solutions to the above equation can be separated into three categories: $\lambda>0$, $\lambda=0$, $\lambda<0$. When $\lambda=0$, the above equation becomes the modified KdV (MKdV) equation. From these solutions ($\lambda\neq0$), they have also obtained new solutions (which also contain a non-zero parameter λ) to the standard MKdV equation. They analyse in detail the solutions for the cases $\lambda>0$ and $\lambda=0$. Many numerical examples are given to illustrate the main features of some of the new solutions. (4 refs.)

69899 **Hamiltonian structure of Sato's hierarchy of KP equations and a coadjoint orbit of a certain formal Lie group.** Y.Watanabe (Hiroshima Univ., Hiroshima, Japan).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.99-106 (March 1983).
A Hamiltonian operator related to Sato's hierarchy of KP equations is derived. The KP equation is regarded as the Hamiltonian equation of motion on a coadjoint orbit of a certain formal Lie group. (7 refs.)

69900 **On equations for wave interactions.** V.K.Mel'nikov (Lab. of Theoretical Phys., JINR, Dubna, USSR).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.129-36 (March 1983).
A number of new nonlinear evolution equations for the interaction of waves on the x, y plane are found. It is shown that these equations may be investigated by the inverse scattering method. (13 refs.)

69901 **On a growing mode of the Boussinesq equation.** N.Yajima (Res. Inst. for Appl. Mech., Kyushu Univ., Fukuoka, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.678-80 (Feb. 1983).
Nonlinear evolution of linearly unstable solution in the Boussinesq system is studied by Hirota's (1973) method. The result shows a peculiar property that the unstable solution neither grows unlimitedly nor falls into a saturation level, but takes the maximum amplitude at a time and thereafter damps. (4 refs.)

Superluminal singular dual wave ....See Entry 69918

Exact, multiple soliton solutions of double sine Gordon field equations ....See Entry 70236

Dispersion of nonlinear waves in a rod ....See Entry 71423

Dispersion of nonlinear spatial waves in a rod ....See Entry 71424

A note on nonlinear elastic wave propagation ....See Entry 71448

Influence of the magnetic field on the phase velocities of surface and volume waves in a perfectly conducting regular layered medium ....See Entry 71456

Approximate representation of dissipation function in case of linear viscoelasticity with variable-amplitude vibrations ....See Entry 71459

The nonlinear Fourier analysis of internal solitons in the Andaman Sea ....See Entry 73831

03.50 CLASSICAL FIELD THEORY

69902 **The electrodynamics with magnetic monopoles. II. Canonical formalism.** K.Hirata (Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.636-52 (Feb. 1983).
For pt.I see ibid., vol.69, no.1, p.300-13 (1983). A relativistic classical Hamiltonian theory of the electrodynamics with electric and magnetic point particles is constructed from a Lagrangian theory by the canonical method. The resulting Hamiltonian theory has a duality symmetry, though this is not easy to see in the Lagrangian theory. This, so to speak, Dirac-Wu-Yang theory may be regarded as a refined version of the Wu-Yang theory. (10 refs.)

69903 **Behaviour of a neutral particle with spin in an axial magnetic field.** S.V.Sorokin, V.Ya.Epp (Lenin Komsomol Pedagogical Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.645-7 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.70-2 (July 1982). [received: May 1983]
The behaviour of a neutral particle with an intrinsic magnetic moment in an axisymmetric constant magnetic field is considered. The trajectory of the particle is found and the dynamics of the spin polarization vector in this field is found. (9 refs.)

Two potential electrodynamics for the particles carrying both the electric and magnetic charges ....See Entry 70238

Dual symmetry in classical and quantum spin theory ....See Entry 70304

03.65 QUANTUM THEORY; QUANTUM MECHANICS

(see also 05.30 Quantum statistical mechanics; for relativistic wave equations, see 11.10)

69904 On the double-well problem for Dirac operators. E.M.Harrell (Dept. of Math., Johns Hopkins Univ., Baltimore, MD, USA), M.Klaus.
Ann. Inst. Henri Poincare Sect. A (France), vol.38, no.2, p.153-66 (1983).
The authors show that the eigenvalues of a Dirac Hamiltonian with two centers of force converge to those of the Hamiltonians with only one center of force in the limit as the spacing goes to infinity. They discuss perturbation theory and show how to estimate the spread of asymptotically degenerate sets of eigenvalues. The methods are for the most part not special to Dirac operators. (16 refs.)

69905 Statistical inference and distance between states in quantum mechanics. B.Diu (Lab. de Phys. Theorique et Hautes Energies, Univ. Paris VII, Paris, France).
Ann. Inst. Henri Poincare Sect. A (France), vol.38, no.2, p.167-74 (1983).
The notion of a distance between quantum states, which was recently proposed as the basis for a general postulate to solve the relative statistical inference question in quantum mechanics, is shown to be inadequate for this purpose; in a class of simple situations (dealing with 'subjective' or 'objective' states, and with 'direct' or 'indirect' information), the new postulate leads either to non-unique answers, or to incorrect ones. (6 refs.)

69906 Odd anharmonic oscillators and shape resonances. E.Caliceti, M.Maioli (Istituto Matematico, Univ. di Modena, Modena, Italy).
Ann. Inst. Henri Poincare Sect. A (France), vol.38, no.2, p.175-86 (1983).
By adapting a stability argument of Vock and Hunziker it is proved that the Borel sum of the Rayleigh-Schrodinger perturbation expansion of any odd anharmonic oscillator $p^2+x^2+gx^{2k+1}$, $k=1, 2, \ldots$, is the limit of a sequence of resonances in the standard sense of dilation analyticity. The same method yields, for a suitable class of potentials, an existence proof of shape resonances. (10 refs.)

69907 Reassembly and time advance in reflectionless scattering. R.E.Crandall, B.R.Litt (Dept. of Phys., Reed Coll., Portland, OR, USA).
Ann. Phys. (USA), vol.146, no.2, p.458-69 (1 April 1983).
The authors show that a wave packet incident on a reflectionless potential will reassemble after the scattering event, but with its mean position always advanced in time. An exact expression for this advance is derived in terms of the bound state spectrum of the potential. They identify two physically distinct correspondence limits in which the time advance agrees with the appropriate classical formula. (12 refs.)

69908 Phase path approximations in the Feynman path integrals. P.P.Fiziev (Lab. of Theoretical Phys., United Inst. of Nuclear Studies, Dubna, USSR).
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.27-35 (1983).
The discretization of the Feynman path integrals for finite dimensional systems has been analysed and the admissible finite dimensional approximations for the paths in phase-space have been found in a general form. The widespread concept of summing over all paths is shown to be incorrect and it should be replaced by summation over a certain class of paths on a family of Mayer's surfaces. (22 refs.)

69909 On one method of approximate solution of the Liouville equations. V.Lisy, L'.Turna (Faculty of Natural Sci., Univ. of P.J. Safarik, Kosice, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.477-9 (1983).
A method of an approximate solution of the Liouville equations is proposed and the domain of its applicability is discussed. (4 refs.)

69910 Elucidation of the probabilistic structure of quantum mechanics and definition of a compatible joint probability. M.Mugur-Schachter (Lab. de Mecanique Quantique, Univ. de Reims, Reims, France).
Found. Phys. (USA), vol.13, no.4, p.419-65 (April 1983).
A new integrated view on the probabilistic organization of quantum mechanics is constructed. It is then proved that for superposition state vectors the theoretical quantum mechanical distribution for the momentum observable is devoid of operational definition, and hence cannot be the source of conditions of compatibility to be imposed upon a researched joint probability concept. A compatible joint probability is defined. (25 refs.)

69911 Correspondence between classical and quantum chaos for hydrogen in a uniform magnetic field. A.Harada, H.Hasegawa (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. A (GB), vol.16, no.8, p.L259-63 (1 June 1983).
It is shown, by numerical computations, that the classical and the quantal critical energy of a hydrogen atom in a uniform magnetic field, characterising the onset of irregular motions, approximately coincide. This result is obtained by applying a simple scaling property of the classical Hamiltonian, valid only for $L_z=0$ (the angular momentum component along the field vanishes), to the numerically deduced relative areas of the irregular region of Poincare surfaces of section. (17 refs.)

69912 Vector bundle representations of groups in quantum physics. M.Asorey, J.F.Carinena (Dept. de Fisica Teorica, Univ. de Zaragoza, Zaragoza, Spain), M.A.del Olmo.
J. Phys. A (GB), vol.16, no.8, p.1603-9 (1 June 1983).
The theory of vector bundle representations of Lie groups G is developed. Induced and locally operating linear representations of G are shown to be generated by vector bundle representations, and gauge equivalence of locally operating linear representations is shown to correspond to equivalence of vector bundle representations. It is pointed out that every vector bundle representation is equivalent to an induced one. Some applications to the quantum systems associated with monopole and instanton gauge field configurations are also discussed. (14 refs.)

69913 Harmonic oscillator with potential barriers—exact solutions and perturbative treatments. W.N.Mei (Dept. of Phys., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA), Y.C.Lee.
J. Phys. A (GB), vol.16, no.8, p.1623-32 (1 June 1983).
Two specific potential-well problems have been solved exactly, firstly, a half-space harmonic oscillator with a finite-potential step and secondly, a full-space harmonic oscillator with an infinite wall located at a finite distance from the origin. The purpose of these studies is to investigate the limiting situations when (i) the finite-potential step in the first case is very high compared with the energy eigenvalues of the low-lying states and (ii) the infinite-potential wall in the second case is at a great distance from the origin where the amplitudes of the wavefunctions of the low-lying states are vanishingly small. The numerical results have been compared with the analytical expressions obtained from the perturbation schemes devised by Lee and Mei. Excellent agreements are obtained. General implications and applications are also discussed. (8 refs.)

69914 *R*-matrix bounds for local potentials. A.E.A.Warburton (Dept. of Appl. Math., Univ. of Hull, Hull, England).
J. Phys. A (GB), vol.16, no.8, p.1633-9 (1 June 1983).
The continuum form of the Hellmann-Feynman theorem is proved, both on and off the energy shell, for potentials satisfying $\int_0^A r|V(r)|dr<\infty$ and $\int_A^\infty |V(r)|dr<\infty$. The corresponding bounds for the phase shifts and off-shell amplitudes are deduced. (7 refs.)

69915 Bound states of two identically charged particles in a harmonic oscillator field. V.I.Osherov, L.V.Poluyanov, A.I.Voronin (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
J. Phys. B (GB), vol.16, no.10, p.L305-8 (28 May 1983).
Complete separation of variables has been carried out for the six-dimensional Schrodinger equation of two particles interacting in a harmonic oscillator field. The dynamical symmetry of the system investigated is discussed. The degeneration of energy levels and their quasiclassical positions have been found. (4 refs.)

69916 Quantum geometry and quantum force: wave and geodesic equations. E.R.Caianiello, G.Scarpetta (Istituto di Fisica, Univ. di Salerno, Salerno, Italy), G.Marmo.
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.15, p.487-90 (9 April 1983). (9 refs.)

69917 Some possible experiments on quantum waves. J.Andrade e Silva (Lab. de Fisica, Univ. de Lisboa, Lisboa, Portugal), F.Selleri, J.P.Vigier.
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.15, p.503-8 (9 April 1983).
The authors discuss three experiments which can be performed with modern techniques and which allow one to probe directly the actual existence of quantum waves in space and time. (15 refs.)

69918 Superluminal singular dual wave. R.Horodecki (Inst. of Theoretical Phys. & Astrophys., Univ. of Gdansk, Gdansk, Poland).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.15, p.509-11 (9 April 1983).
The dual wave to the Mackinnon soliton-like wave (1978, 1981) is considered in terms of the 'three wave' hypothesis. (7 refs.)

69919 Stochastic linear maps and transition probability. P.M.Alberti, A.Uhlmann (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.107-12 (March 1983).
Some aspects of the transition probability $P(\omega, \nu)$ between states ω, ν on unital *-algebras are discussed. It is shown that P increases under the action of any stochastic linear map T, i.e., $P(T\omega, T\nu)\geq P(\omega, \nu)$. Some properties of P are derived in starting from a recently-proved characterization of the quantity in question. (8 refs.)

69920 Asymptotic localization and separation and the scattering of quantum states. Kay-Kong Wan, R.G.D.McLean (Dept. of Theoretical Phys., Univ. of St. Andrews, St. Andrews, Scotland).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.76-8 (18 April 1983).
The concepts of asymptotic localization and separation of quantum states introduced in a previous paper are generalized to the n-dimensional case. An application of these ideas to a simple scattering situation leads to an intuitively pleasing picture of scattering. (4 refs.)

69921 Quasiclassical perturbation theory for quantum K-system. G.P.Berman, A.M.Iomin (Kirensky Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.79-81 (18 April 1983).
A quantum-dynamical system satisfying the condition of stochastic instability in the classical limit is studied. Behavioural properties of perturbation-theory series in powers of $\hbar$ for such systems are discussed. The quantum corrections in the expressions for physical averages over the density matrix are shown to increase exponentially at small times. (6 refs.)

69922 Exact evaluation of a path integral with generalised memory. K.L.Sebastian (Inst. fur Phys. Chem., Univ. Munchen, Munich, Germany).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.131-2 (25 April 1983).
A simple procedure for the evaluation of a path integral whose action contains a generalised memory term is given. It is pointed out that the procedure may also be used to evaluate path integrals involving slightly more generalised memory. (2 refs.)

69923 Reply to Lynch [Koc's thought-experiment]. Y.Koc (Bogazici Univ., Istanbul, Turkey).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.133-4 (25 April 1983).
Lynch's alternate analysis (see ibid., vol.92, p.161, 1982) on Koc's thought-experiment is consistent with quantum mechanics. However, Lynch's analysis does not resolve the paradox which is implied by Koc's thought-experiment. (4 refs.)

69924 Correspondence limit in the Wigner-Weyl picture. T.B.Smith (Phys. Dept., Open Univ., Milton Keynes, England).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.219-22 (2 May 1983).
Derives the correspondence limit matrix elements for an operator in terms of its Weyl transform. This treatment therefore can be used to estimate matrix elements for operators lacking a well-defined classical limiting form. The author gives a systematic asymptotic expansion for harmonic oscillator matrix elements. (10 refs.)

69925 Painleve property of anharmonic systems with an external periodic field. W.-H.Steeb (Univ. Paderborn, Paderborn, Germany), A.Kunick.
Phys. Lett. A (Netherlands), vol.95A, no.6, p.269-72 (9 May 1983).
The Painleve property of anharmonic systems with an external periodic field is investigated. This property tells one that the only movable singularities exhibited by the solutions are poles. The Painleve property can serve to distinguish between integrable and nonintegrable systems. (19 refs.)

69926 Comment on 'Path integration of a quadratic action with a generalized memory'. E.Bosco (Dept. of Inorganic & Phys. Chem., Indian Inst., of Sci., Bangalore, India).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.277-8 (9 May 1983).
For original paper see Khandekar et al., ibid., vol.93, p.167 (1983). Using the promeasure technique, the author gives an alternative evaluation of a path integral corresponding to a quadratic action with a generalized memory. (3 refs.)

69927 Convergent perturbation expansion for the anharmonic oscillator. C.K.Au, G.W.Rogers, Y.Aharonov (Dept. of Phys. & Astron., Univ. of South Columbia, SC, USA).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.287-92 (9 May 1983).
The authors study the ground state as well as the first three excited states of the anharmonic oscillator with anharmonicity λx^4 for a range of $\lambda=(0,10)$ with the first-order logarithmic perturbation iteration method (FOLPIM). This leads to convergent results. The initial choice of the wave function seems only to affect the rate of convergence in the case of the ground state but may critically affect the convergence for the excited states. For large values of λ, convergence is best obtained by choosing the asymptotic solution as the initial 'unperturbed' wave function. (29 refs.)

69928 Equivalent local potentials and Perey factors for various kinds of relative wave functions of RGM. I. Formulation. H.Horiuchi (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.516-34 (Feb. 1983).
Using the same WKB treatment as applied successfully to the non-local potential for the usual RGM relative wave function χ, the equivalent local potential and the Perey factor are derived for the other types of RGM relative wave functions $\sqrt{N}\chi$ and $N\chi$ where N is the normalization kernel. The equivalent local potentials for χ, $\sqrt{N}\chi$ and $N\chi$ are shown to be the same as each other. χ, $\sqrt{N}\chi$ and $N\chi$ have a common flux and it is compared with the flux by the equivalent local potential. Reliability of the WKB treatment is shown to be high by a numerical check of the accuracy of semi-classical relations among χ, $\sqrt{N}\chi$ and $N\chi$ derived by the WKB treatment. (13 refs.)

69929 Violations of Bell's inequality in cooperative states. P.D.Drummond (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1407-10 (9 May 1983).
Cooperative multiparticle quantum states in an Einstein-Podolsky-Rosen type of experiment are shown to violate a Bell inequality. Thus correlations can occur between wave packets each having N bosons which cannot be explained within local hidden-variable theories. This provides a way to test quantum measurement theory for multiparticle states. In these states, a local, positive probability distribution exists for all N. However, the representation of correlations with this probability distribution is different from that in standard (Bell-type) hidden-variable theories. (12 refs.)

69930 Wigner-Kirkwood expansion of *N*-body Green's function: the case with magnetic field. E.Tirapegui (Faculte des Sci., Univ. Libre de Bruxelles, Brussels, Belgium), F.Langouche, D.Roekaerts.
Phys. Rev. A (USA), vol.27, no.5, p.2649-55 (May 1983).
A systematic method is given to compute the semiclassical Wigner-Kirkwood expansion of the off-diagonal thermal kernel of an N-body quantum system. (7 refs.)

69931 Comments about energies of parameter-dependent systems. F.M.Fernandez, E.A.Castro (INIFTA, La Plata, Argentina).
Phys. Rev. A (USA), vol.27, no.5, p.2735-7 (May 1983).
It is shown that the proper dependence of eigenvalues with respect to the parameters and quantum numbers can be found by calculating the extremum of the energy functional. (4 refs.)

69932 Universal unfolding of Hamiltonian systems: from symplectic structure to fiber bundles. F.Zaccaria (Istituto di Fisica Teorica, Univ. di Napoli, Napoli, Italy), E.C.G.Sudarshan, J.S.Nilsson, N.Mukunda, G.Marmo, A.P.Balachandran.
Phys. Rev. D (USA), vol.27, no.10, p.2327-40 (15 May 1983).
The problem of the global Lagrangian description of a dynamical system which has a global Hamiltonian description is considered; the motion of a charged particle in the field of a static magnetic monopole is a prototype of such dynamical problems. The symplectic structure on the (cotangent bundle of the) manifold is associated with a closed but not necessarily exact two-form. In conventional language this means that the tensor field inverse to the symplectic metric is divergence free but not necessarily expressible globally as the curl of a vector field; and hence the usual passage to Hamilton's principle and the Lagrangian can be carried out in patches but not necessarily globally. Generalizing techniques developed elsewhere, the authors show that the fundamental expression for the action integral is like the surface integral of the closed but not necessarily exact antisymmetric tensor field (two-form) rather than like the line integral of a vector field (one-form). This naturally leads to the path-space formalism in which the action functional depends not only on a point in configuration space but also a path from a chosen fixed point terminating in the relevant point in configuration space. They then show how this is a 'universal unfolding' and how the topological obstructions in the configuration-space description are circumvented in the path-space description. The path-space description contains redundancies and they can be reduced; locally the new manifold is obtained by associating an angle of rotation [a U(1) fiber] with each configuration-space point, but globally there would be a nontrivial fiber-bundle structure. These questions naturally carry over to the quantum theory of such systems and it is shown how quantization conditions arise. The structure of the quantum-theory formalism for such systems is analyzed. The considerations are applied to the monopole problem where the enlarged space in which the Lagrangian description is possible is explicitly identified as the manifold of the group SU(2). (8 refs.)

69933 Error estimates for piecewise perturbation series solutions of the radial Schrodinger equations. M.D.Smooke (Appl. Math. Div., Sandia Nat. Labs., Livermore, CA, USA).
SIAM J. Numer. Anal. (USA), vol.20, no.2, p.279-95 (April 1983).
When the coefficient matrix $P(r)$ of the radial Schrodinger equation is approximated by a matrix of piecewise polynomials, the equation can be rewritten in a form such that a piecewise perturbation series solution can be obtained. Error estimates are obtained for the error incurred by solving the radial Schrodinger equation in this manner. (26 refs.)

69934 Systems of equations of n-waves and nonlinear Schrodinger equations from the group-theoretical point of view. A.V.Zhiber (Ufa Aviation Inst., Ufa, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.882-8 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.405-13 (Sept. 1982). [received: May 1983]
Studies a group-theoretical analysis of a system of equations of n-waves and a system of nonlinear Schrodinger equations. The Lie-Backlund algebras of these equations are fully described. These algebras are commutative, and there is a one-to-one correspondence between them and the commutative Lie algebras of the conservation laws. The connection between the Lie-Backlund algebras of the considered systems of equations is found. (7 refs.)

69935 Quasiclassical particle in a one-dimensional self-consistent field. S.I.Chernykh (Moscow Inst. of Electronic Engng., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.939-41 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.491-4 (Sept. 1982). [received: May 1983]
Langer's method (1956) is used to construct a quasiclassical series of eigenfunctions for a one-dimensional self-consistent field equation. (6 refs.)

69936 Explicit solution of the wave equation for a symmetric triple-well potential. R.S.Kaushal (Dept. of Phys., Univ. of Delhi, Delhi, India), H.O.Sharma.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.48
In the past few years, several approaches have been used to obtain fairly accurate eigenvalues for an anharmonic oscillator potential of the type bx^2+cx^4, which represents a double-well feature. Recently, Muller-Kirsten and Mansour and Muller-Kirsten have also obtained the eigenvalues and eigenfunctions for this potential using a perturbative procedure. The authors apply this method of Muller-Kirsten to a symmetric triple-well potential. In particular, they obtain the eigenvalues and eigenfunctions for a potential of the type $bx^2+cm^4+x^6$, in the form of analytic asymptotic expansions. Also, two pairs of solutions of the wave equation are obtained and their matching is considered in different regions.

Quantum logic .... See Entry 69815

Elementary particle resonances from a semiclassical perspective .... See Entry 69816

Retarded square-well potential .... See Entry 69830

Linearization of nonlinear differential-difference equations .... See Entry 69861

Hamiltonian structure of Sato's hierarchy of KP equations and a coadjoint orbit of a certain formal Lie group .... See Entry 69899

On equations for wave interactions .... See Entry 69900

Deterministic model of spin and statistics .... See Entry 69974

Energy inequalities $\binom{N}{2}^{-1}E_N<\binom{K}{2}^{-1}E_K$, $2<K<N$, relating two systems of identical bosons .... See Entry 69975

On states, on a lattice, with half-integral charge .... See Entry 70005

Quantum inverse scattering method and the diagonal-to-diagonal transfer matrix of vertex models .... See Entry 70006

Main field and symmetric-hyperbolic form of the Dirac equation .... See Entry 70180

Scattering theory for quantum dynamical semigroups. II .... See Entry 70241

Aspects of supersymmetric quantum mechanics .... See Entry 70243

Damping state method and kaonic bound states .... See Entry 70407

Laplace transform method for off-shell scattering on nonlocal potentials .... See Entry 70509

A coupled channel computing code for neutron-nucleus reactions .... See Entry 70510

Remarks on the experiment of winding number dependence of the Aharonov-Bohm effect .... See Entry 72567

On the gauge equivalence of the Landau-Lifshitz and the nonlinear Schrodinger equations on symmetric spaces .... See Entry 72573

03.70 THEORY OF QUANTIZED FIELDS

(see also 11.10 Field theory)

Solution of operator field equations by the method of finite elements .... See Entry 70017

03.80 GENERAL THEORY OF SCATTERING

(see also 11.20 S-matrix theory, and 11.80 Relativistic scattering)

69937 High energy scattering theory of many-particle system. Ruan Tu-nan (Univ. of Sci. & Technol. of China, China), Wang Wei-wei, Li Yang-guo, Zhang Yu-shun.
Commun. Theor. Phys. (China), vol.1, no.1, p.49-58 (1982).
Within the framework of the Glauber theory, the authors divide the many-particle system into two subsystems, formed by the 'Valence' particles and the 'Sea' particles respectively. Then the multiple scattering amplitudes can also be divided into 'sea'-'sea', 'sea'-'valence', 'valence'-'sea', and 'valence'-'valence' multiple scattering amplitudes. For the calculation of these different amplitudes, different effective approximate methods are proposed. Finally, the S matrix for the 'sea'-'sea', 'sea'-'valence', 'valence'-'sea' and 'valence'-'valence' processes is obtained. (3 refs.)

69938 Initial states of maximal entropy in formal scattering theory. P.Pfeifer, R.D.Levine (Fritz Haber Res. Center for Molecular Dynamics, Hebrew Univ., Jerusalem, Israel).
J. Chem. Phys. (USA), vol.78, no.8, p.4938-46 (15 April 1983).
For a precollision state which is not sharply defined, not all details of the dynamics can be obtained by examination of the final state. A version of formal collision theory which takes full advantage of the inherent loss of detail is provided. Only the relevant aspects of the dynamics need then be computed and an explicit identification of the relevant details is provided by a generalized intertwining theorem. Several explicit examples where this point of view can be implemented are worked out. (21 refs.)

69939 A stationary proof of Lavine's formula for time-delay. A.Jensen (Centre de Phys. Theorique, CNRS, Marseille, France).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.137-43 (March 1983).
Lavine's formula (1974) gives a connection between time-delay and potential in scattering theory. A proof is given for potentials $V=V_1+V_2$, $|V_1(x)|+|x.\nabla V_1(x)|\leq c(1+|x|)^{-1-\epsilon}$. $V_2(x)=O(|x|^{-2-\epsilon})$ as $|x|\rightarrow\infty$, using the stationary method. A new stationary representation for the time-delay operator is found. (9 refs.)

04.00 RELATIVITY AND GRAVITATION

(for special relativity, see 03.30; for relativistic astrophysics, see 95.30; for relativistic cosmology, see 98.80)

04.20 GENERAL RELATIVITY

(see also 02.40 Geometry and topology)

69940 Natural coordinates for an accelerated observer. P.Mitra (Barasat Government Coll., Barasat, West Bengal, India), S.Datta Majumdar.
Fizika (Yugoslavia), vol.15, no.1, p.93-113 (Jan.-March 1983).
The line element for an accelerated observer is derived by assuming linearity of transformation between his coordinates for any given time and a system of Galilean coordinates. It is noted that any 4×4 orthogonal matrix $[a]$ with a_{i4}, a_{4i} imaginary, a_{44} and other elements real represents a possible transformation from an inertial to an accelerated frame. Examples of such matrices are given and the associated angular velocities calculated. Finally, by a suitable interpretation of the Eulerian matrix giving the orientation of a rigid body in space the matrix representing the general motion of a frame on an inertial plane is obtained. (8 refs.)

69941 Surface integrals and the gravitational action. J.M.Charap, J.E.Nelson (Dept. of Phys., Queen Mary Coll., London, England).
J. Phys. A (GB), vol.16, no.8, p.1661-8 (1 June 1983).
The authors discuss the modifications needed to free the Einstein-Hilbert action of gravitation from all second derivatives of fields, and give explicitly the resulting action applicable to either metric or vierbein variables. Variation of this action leads to Einstein's equations without boundary conditions. It vanishes for flat space-time and contains one arbitrary real parameter. (16 refs.)

69942 Rotating fluid spheres. B.W.Stewart (Dept. of Phys., Thomas More Coll., Ft. Mitchell, KY, USA).
J. Phys. A (GB), vol.16, no.8, p.1689-93 (1 June 1983).
A new exact solution to the 'slow rotation' structure equations is presented. It is briefly compared with the slowly rotating limit of the Wahlquist solution, with which the new solution shares an equation of state. (7 refs.)

69943 On the Kramer-Neugebauer spinning masses solutions. M.Yamazaki (Dept. of Phys., Kanazawa Univ., Kanazawa, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.503-15 (Feb. 1983).
It is shown that the three metric functions f, ω and γ of collinear N Kerr particles ($N=1, 2, 3, \ldots$) are written, in terms of six determinants of degree N (J, K, L, M, S and T), in a concise closed form. The conditions both for the regularity of the metric on the symmetrical z axis and for the positive total mass are discussed. The two hitherto unnoticed potentials L and M are introduced in order to evaluate the metric function ω. (7 refs.)

69944 Generalized constraint structure for gravitation theory. A.Komar (Physics Div., Nat. Sci. Found., Washington, DC, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2277-81 (15 May 1983).
By exploiting the conformal symmetry inherent in the Einstein theory the author constructs a more general form for the Dirac constraints involving an arbitrary function. This more general form is required if a canonically quantized theory is to accommodate renormalization. (7 refs.)

69945 Bianchi type-I models with conformally invariant scalar field. A.J.Accioly, A.N.Vaidya, M.M.Som (Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
Phys. Rev. D (USA), vol.27, no.10, p.2282-4 (15 May 1983).
The solutions of the Einstein equations with the trace-free energy-momentum tensor of conformally invariant scalar field as source are obtained in a spatially homogeneous anisotropic space-time. Some interesting features of the solutions are discussed. (6 refs.)

69946 Elastic scattering in the Zipoy-Voorhees metric. J.P.Krisch (Dept. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2305-9 (15 May 1983).
The elastic scattering of test particles from an oblate static source is examined. The elastic cross section for scatterings in the equatorial plane is calculated and compared to the Schwarzschild cross section. Equations determining the critical angular momentum as a function of energy and oblateness are derived. (5 refs.)

69947 Absolute nature of the thermal ambience of accelerated observers. U.H.Gerlach (Center for Theoretical Phys., Univ. of Texas, Austin, TX, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2310-15 (15 May 1983).
The blackbody radiation (thermal ambience) surrounding a linearly and uniformly accelerated observer is shown to be totally isotropic. By contrast, an observer who does not merely have this uniform acceleration into some direction, but also (a) drifts uniformly (according to his own clock) into another, or alternatively (b) orbits uniformly around a fixed axis, will be surrounded by vacuum fluctuations with the spectrum of a blackbody endowed with a chemical potential. This potential is proportional to the drift velocity for one observer, and to the angular velocity for the other. These chemical potentials express an anisotropy of empty flat space relative to these observers. (14 refs.)

69948 Gauss-Tolman theorem and positivity of the total mass-energy for a nonstatic sphere in the general theory of relativity. V.A.Ruban (B.P. Konstantinov Leningrad Inst. of Nuclear Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.249-57 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.460-74 (Aug. 1982). [received: May 1983]
A generalization is given of Tolman's potential form of the integral of the total mass-energy for nonstatic, centrally symmetric matter distributions in R regions of V_4. A local conservation law for the total energy of the gravitational field and matter in general relativity is discussed on the basis of the quasi-Newtonian Gauss-Tolman theorem. It is shown that the Schwarzschild mass, the equivalent of the total energy, is positive in the presence of T regions in 'semiclosed' models of a sphere, and thus the gravitational mass defect cannot exceed the total self-energy of the matter. (20 refs.)

Space-time symmetries and the gravitational-neutrino field equations in general relativity .... See Entry 69955

Gauge theory of gravity .... See Entry 69957

The renormalized coupling constant in an open static Einstein universe .... See Entry 74190

Could the metastable vacuum burn .... See Entry 74193

04.30 GRAVITATIONAL WAVES AND RADIATION: THEORY

69949 An heuristic introduction to gravitational waves. V.D.Sandberg (Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.96, p.325-30 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
The author describes in physical terms the phenomenon of gravitational waves. The philosophy of William Gilbert (1952) is used. (6 refs.)

The minimum period and the gap in periods of cataclysmic binaries .... See Entry 74073

Nonradial *g*-mode oscillations of warm neutron stars .... See Entry 74099

Post-Newtonian gravitational radiation of a system of two compact objects in the field theory of gravitation .... See Entry 74117

04.40 CONTINUOUS MEDIA; ELECTROMAGNETIC AND OTHER MIXED GRAVITATIONAL SYSTEMS

69950 Entropy bounds and the second law for black holes. J.D.Bekenstein (Phys. Dept., Ben Gurion Univ., Beer Sheva, Israel).
Phys. Rev. D (USA), vol.27, no.10, p.2262-70 (15 May 1983).
A counterexample to the entropy bound proposed by Unruh and Wald (1982) and by Page (1982) is described. The bound states that the entropy S of any system with energy E and volume V cannot exceed the entropy of an equal volume and energy of unconfined thermal radiation. The bound is found to be violated by thermal field systems whose various dimensions differ by an order of magnitude or more, the violation occurring at intermediate energies. Unruh and Wald used the bound in an argument establishing the validity of the generalized second law when a box containing some entropy is lowered to near a black hole, then opened, and withdrawn open. If the box is thin in one direction, the failure of the bound for its contents makes it appear that a violation of the second law is possible. The author shows that, in fact, for a thin box the buoyancy effects on which Unruh and Wald's argument relies cancel out. As a result, the second law is fulfilled despite the failure of the bound. It appears from the second law that the bound must nevertheless hold when applied to box plus contents, but a direct proof of this is still lacking. The author also considers the alternative entropy bound $S \leq 2\pi ER/\hbar c$($2R$ is the largest dimension of the system) proposed earlier. For field systems it is shown to fail at very low energies, but to be valid for complete systems (i.e., box plus confined fields). Further, the author shows $S \leq 2\pi ER/\hbar c$ is a necessary condition for fulfillment of the second law when a thin system is dropped into a black hole (even in the face of buoyancy) in the sense that if the bound failed, the law would be violated. (16 refs.)

69951 Entropy bounds, acceleration radiation, and the generalized second law. W.G.Unruh (Dept. of Phys., Univ. of British Columbia, Vancouver, British Columbia, Canada), R.M.Wald.
Phys. Rev. D (USA), vol.27, no.10, p.2271-6 (15 May 1983).
The authors calculate the net change in generalized entropy occurring when one attempts to empty the contents of a thin box into a black hole in the manner proposed recently by Bekenstein (1983). The case of a 'thick' box also is treated. It is shown that, as in the previous analysis (1982), the effects of acceleration radiation prevent a violation of the generalized second law of thermodynamics. Thus, in this example, the validity of the generalized second law is shown to rest only on the validity of the ordinary second law and the existence of acceleration radiation. No additional assumptions concerning entropy bounds on the contents of the box need to be made. (7 refs.)

Rotating fluid spheres .... See Entry 69942

A relationship between the electrovacuum Ernst equations and nonlinear σ-model .... See Entry 69953

Unification of generalized electromagnetic and gravitational fields .... See Entry 69958

Effect of a single coordinate system of curvature on the properties of the boundary between *R*- and *T*-regions and the energy-momentum tensor .... See Entry 74089

Temperature dependent gravitational constant and black hole physics .... See Entry 74102

04.50 UNIFIED FIELD THEORIES AND OTHER THEORIES OF GRAVITATION

69952 Conservation laws and string-like matter distributions. A.Jadczyk (Inst. fur Theoretische Phys., Univ. Gottingen, Gottingen, Germany).
Ann. Inst. Henri Poincare Sect. A (France), vol,38, no.2, p.99-111 (1983).
Equations of motion for singular distributions of matter, like point particles, strings, membranes and bags are derived by Souriau method. Interactions with metric tensor, non-Abelian gauge fields and G-structures are taken into account. Particles carrying spinorial charges in super-gravity field are also examined. (15 refs.)

69953 A relationship between the electrovacuum Ernst equations and nonlinear σ-model. P.O.Mazur (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.4, p.219-39 (April 1983).
The Ernst equations for the stationary Einstein-Maxwell fields are shown to be connected with the field theory of harmonic map from the Riemann three-space (M, h_{ik}) into a Kahler symmetric space $SU(2,1)/SU(2)\times U(1)$ i.e. the non-linear σ-model on symmetric space of the covariance group of these equations; similarly, the vacuum Ernst equations can be interpreted as the σ-model on $SU(1,1)/U(1)$. The formulation of Ernst's equations in terms of $SU(2,1)$-valued field subject to a quadratic constraint, which realizes an embedding of a Kahler symmetric space into the covariance group is given. For the axially symmetric fields it is shown that Ernst's equations are integrable. The Zakharov-Shabat null-curvature representation of these equations and the corresponding linear system of equations is presented. It is conjectured that an infinite-dimensional group of transformations acting on the solution space of the Ernst equations, which appears naturally in this approach, is connected with the Geroch-Kinnersley group. (39 refs.)

69954 The nonsymmetric-nonabelian Kaluza-Klein theory. M.W.Kalinowski (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
J. Phys. A (GB), vol.16, no.8, p.1669-88 (1 June 1983).
The author considers an $(n+4)$-dimensional unification of Moffat's theory of gravitation and Yang-Mills field theory with nonabelian gauge group G. The author found 'interference effects' between gravitational and Yang-Mills (gauge) fields which appear to be due to the skewsymmetric part of the metric of Moffat's theory and the skewsymmetric part of the metric on the group G. The unification, called the nonsymmetric-nonabelian Kaluza-Klein theory, becomes classical Kaluza-Klein theory if the skewsymmetric parts of both metrics are zero. (23 refs.)

69955 Space-time symmetries and the gravitational-neutrino field equations in general relativity. C.A.Kolassis (Lab. de Phys. Theorique, Inst. Henri Poincare, Paris, France).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.82-4 (18 April 1983).
Considers a neutrino field with geodesic rays in interaction with a gravitational field admitting a Killing vector field n^{μ}. It is found that for solutions of the Einstein-Weyl field equations the neutrino field ξ^{A} and the neutrino flux vector l^{μ} are restricted by the equations: $L_n\xi^{A}=-{}^1/_2 is\xi^{A}$ and $L_n l^{\mu}=0$, where s is a real constant. In the case of pure radiation neutrino fields these equations become: $L_n\xi^{A}={}^1/_2(p-is)\xi^{A}$, $L_n l^{\mu}=pl^{\mu}$, where p and s are in geneal real functions of the coordinates. (3 refs.)

69956 Spontaneous symmetry breaking in Kaluza-Klein theories. A.Karlhede, T.Tomaras (California Inst. of Technol., Pasadena, CA, USA).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.49-53 (19 May 1983).
The authors study the bosonic spectrum of Kaluza-Klein theories by considering the symmetries of the vacuum. They find that the introduction of external gauge fields with non-vanishing vacuum expectation values affects the massless vectors and may break isometries of the internal space making the corresponding gauge vectors massive. (9 refs.)

69957 Gauge theory of gravity. H.R.Pagels (Rockefeller Univ., New York, NY, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2299-304 (15 May 1983).
The author develops an O(5) gauge theory in which the 0(5) symmetry is spontaneously broken to 0(4) with a scale on the order of the Planck mass. The ten components of the 0(5) gauge field are identified as the four vierbeins and six connections of Euclidean general relativity. In the strong-coupled limit the effective action is dominated by a dimension-five operator induced by the anomalous fermion triangle loop which turns out to be the usual Hilbert action. The metric is not a dynamical field in this model and its equation of constraint is just the usual metric-vierbein relation. The author suggests $SU(9) \supset SU(5) \times 0(5)$ as the simplest group for a totally unified theory. (14 refs.)

69958 Unification of generalized electromagnetic and gravitational fields. B.S.Rajput (Dept. of Phys., Kumaun Univ., Naini Tal, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.53
Postulating the Heavisidian monopole and keeping in mind the recent interest in the linear equations for gravitational field, the structural symmetry between the generalized gravitational field and the generalized electromagnetic field (associated with dyons) has been demonstrated and the field equations, equations of motion and the quantization conditions for angular momentum which operates for both these fields have been unified in a consistent symmetrical manner. It has also been shown that Heavisidian monopoles are the most strongly interacting form of matter.

04.60 QUANTUM THEORY OF GRAVITATION

69959 Space-time foam, induced by one-loop quantum-gravitational corrections. L.A.Kofman (Inst. of Astrophys. & Atmospheric Phys., Acad. of Sci., Tartu, Estonian SSR).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.165-7 (28 April 1983).
Space-time may have large fluctuations of geometry on short-length scales, which are induced by one-loop quantum-gravitational corrections. Some instanton-like self-consistent solutions have been found, which describe these space-time fluctuations. (9 refs.)

69960 Linear conformal quantum gravity. B.Binegar, C.Fronsdal, W.Heidenreich (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2249-61 (15 May 1983).
This paper is an investigation of field theories that satisfy the following two criteria: (1) Among the propagation modes is a pair of massless particles with helicities ±2. (2) The canonical commutation relations are conformally invariant. This study of 'linear conformal gravity' is motivated by the belief that conformal invariance may be the key to a future theory of quantum gravity. The first conclusion is that the fields of linear conformal gravity include a tensor field of rank 3 and mixed symmetry, and a symmetric tensor field of rank 2, tentatively interpreted as a torsion field and a metric field. The free quantum field operator is constructed explicitly, and the propagator is calculated. The Fourier transform is of dimension p^{-4}, which is encouraging for renormalizability. The field inevitably carries along a nonunitary ghost, similar to the one that turns up in linearized Weyl gravity. The main result is that the ghost can be exorcised by imposing constraints on the external sources and boundary conditions on the physical states. (13 refs.)

Quantum geometry and quantum force: wave and geodesic equations .... See Entry 69916

Generalized constraint structure for gravitation theory .... See Entry 69944

Microcanonical quantum field theory .... See Entry 70167

Instability of higher dimensional Yang-Mills systems .... See Entry 70206

Post-Newtonian gravitational radiation of a system of two compact objects in the field theory of gravitation .... See Entry 74117

04.65 SUPERGRAVITY

69961 Supergravity generates hierarchies. H.P.Nilles (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.366-80 (23 May 1983).
It is argued that local supersymmetry might provide us with a solution to the hierarchy problem. The Planck mass, the grand unification scale and the scale of weak interaction breakdown might be understood in terms of each other. The general mechanism is outlined and the resulting low-energy sector is discussed. It is pointed out that there are several inequivalent ways to fine tune the cosmological constant. (35 refs.)

69962 Petrov classification of supergravity. C.Pilot (Max-Planck-Inst. fur Phys. und Astrophys., Werner Heisenberg Inst. fur Phys., Munich, Germany).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.465-88 (23 May 1983).
$N=1$ supergravity is analyzed in light of the Petrov classification scheme. It is found that the $(2, {}^3/_2)$ chiral multiplet obtained must be recognized as the Weyl submultiplet, W_{abc}, where only $({}^3/_2, 0)+(0, {}^3/_2)$ components contribute. Due to the SUSY transformation laws the classes of solutions allowed for various Petrov types are shown to be restrictive—indeed, in certain instances there can be no consistent solution. The freedom left in the solutions and their possible interpretation are discussed. One-loop invariants are also considered by resorting to noncovariant forms. (13 refs.)

69963 Conformal supergravity in ten dimensions. E.Bergshoeff (Inst.-Lorentz, Leiden, Netherlands), M.de Roo, B.de Wit.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.489-530 (23 May 1983).
The authors present the complete off-shell structure of conformal supergravity in ten dimensions. It is based on 128+128 degrees of freedom and its formulation requires differential constraints. They study how these constraints are resolved in four and five dimensions. Covariant conditions are given that restrict conformal supergravity to its on-shell Poincare counterpart. In ten dimensions the relationship between the two theories has new and unusual aspects, which are explored in a variety of ways. The authors rewrite on-shell Poincare supergravity in a superconformally invariant form, from which they deduce that its off-shell version must contain at least a scalar (chiral) multiplet. They analyze some aspects of the nonlinear structure of the field representation based on the conformal fields combined with one scalar multiplet. (19 refs.)

69964 Constraints on the stability of mass hierarchies in supergravity. H.P.Nilles, M.Srednicki, D.Wyler (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.337-40 (5 May 1983).
The authors study supersymmetric grand unified models coupled to $N=1$ supergravity with a gauge hierarchy induced by the breakdown of local supersymmetry, and a low energy scale given by the gravitino mass. Certain conditions must be fulfilled for this hierarchy to remain stable in perturbation theory. They discuss these constraints and show that most presently available models do not have a stable hierarchy. (13 refs.)

69965 Vacuum energy in gauged extended supergravity. B.Allen, S.Davis (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.353-6 (5 May 1983).
The one loop vacuum energy in gauged extended supergravity is calculated in anti de Sitter space using zeta function regularisation. It vanishes for $N \geq 5$. The energy zeta function has no poles for $N \geq 3$. (11 refs.)

69966 Ten into four won't go. D.Z.Freedman, G.W.Gibbons, P.C.West (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.491-2 (12 May 1983).
It is shown that nontrivial spontaneous compactification of ten-dimensional $N=1$ supergravity with or without Yang Mills matter is not possible unless maximal symmetry (i.e. Lorentz invariance) is violated in the four-dimensional spacetime. (9 refs.)

69967 Gauged seven-dimensional supergravity. P.K.Townsend (Lab. de Phys. Theorique, Ecole Normale Superieure, Paris, France), P.van Nieuwenhuizen.
Phys. Lett. B (Netherlands), vol.125B, no.1, p.41-6 (19 May 1983).
The authors construct Yang-Mills theory and simple supergravity in seven dimensions. They gauge the rigid SU(2) symmetry of the latter. The potential for the scalar field ϕ is of the form $\exp(\phi)$ and has no extremum. Possible improvement due to a 'topological mass term' is discussed. (13 refs.)

69968 Supergravity as the messenger of supersymmetry breaking. L.Hall (Dept. of Phys., Univ. of California, Berkeley, CA, USA), J.Lykken, S.Weinberg.
Phys. Rev. D (USA), vol.27, no.10, p.2359-78 (15 May 1983).
A systematic study is made of theories in which supergravity is spontaneously broken in a 'hidden' sector of superfields that interact with ordinary matter only through supergravity. General rules are given for calculating the low-energy effective potential in such theories. This potential is given as the sum of ordinary supersymmetric terms involving a low-energy effective superpotential whose mass terms arise from integrating out the heavy particles associated with grand unification, plus supersymmetry-breaking terms that depend on the details of the hidden sector and the Kahler potential only through the values of four small complex mass parameters. The result is not the same as would be obtained by ignoring grand unification and inserting small mass parameters into the superpotential from the beginning. The general results are applied to a class of models with a pair of Higgs doublets. (23 refs.)

69969 Integration over surfaces in superspace. A.V.Gaiduk, O.M.Khudaverdyan, A.S.Shvarts (Moscow Engng. Phys. Inst., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.862-8 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.375-83 (Sept. 1982). [received: May 1983]
A study is made of (m,n)-densities, which are the most general entities that can be integrated over a (m,n)-dimensional surface in superspace. It is shown that the Bernshtein-Leites integral forms can be interpreted as densities; the class of densities corresponding to these forms is characterized. (6 refs.)

Conservation laws and string-like matter distributions .... See Entry 69952

Ten-dimensional supersymmetric Yang-Mills theory is not ultraviolet finite on-shell .... See Entry 70198

Unconstrained prepotentials in extended superspace .... See Entry 70205

Instability of higher dimensional Yang-Mills systems .... See Entry 70206

Compactification of supergravity plus Yang-Mills in ten dimensions .... See Entry 70207

General results on the low energy effective theory for $N=1$ local supersymmetry .... See Entry 70257

Gauge hierarchy generation and cosmology in locally supersymmetry GUTS .... See Entry 70278

On the gravitational interaction of a massless spin-5/2 particle .... See Entry 70282

Light singlet, gauge hierarchy and supergravity .... See Entry 70284

04.80 EXPERIMENTAL TESTS OF GENERAL RELATIVITY AND OBSERVATIONS OF GRAVITATIONAL RADIATION

69970 Review of resonant bar gravity wave experiments. W.C.Oelfke (Louisiana State Univ., Baton Rouge, LA, USA).
AIP Conf. Proc. (USA), no.96, p.331-5 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
A review is given of the experimental efforts since 1958 to detect gravitational waves using Weber-type resonant bar antennas. Special attention is paid to the continued funding of and collaboration between research groups and the importance of this kind of support in experimental searches for rare events. Evidence for an atmosphere of mutual support between gravitational wave groups on an international level is seen in the rapid progress toward greater antenna sensitivity and improved measurement techniques. (22 refs.)

69971 Laser interferometer gravitational radiation detectors. R.W.P.Drever (California Inst. of Technol., Pasadena, CA, USA).
AIP Conf. Proc. (USA), no.96, p.336-46 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
Some techniques proposed or currently under development for detection of gravitational radiation by laser interferometers are reviewed, with particular emphasis on experiments covering the lower frequencies potentially accessible to ground based instruments. (12 refs.)

69972 Prospects for ground based detectors of low frequency gravitational radiation. R.Spero (California Inst. of Technol., Pasadena, CA, USA).
AIP Conf. Proc. (USA), no.96, p.347-50 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
Substantial effort will be required to minimize seismic and thermal noise in low frequency (below 100 Hz) gravitational wave detectors. The ultimate

limit to the sensitivity of earthbound detectors is time-varying gravitational gradients due to atmospheric activity; a practical lowest frequency for sensitive operation may be about 0.1 Hz. (7 refs.)

69973 High-energy gravitational antennas: a theoretical approach. F.de Felice (Istituto di Fisica Univ. di Padova, Padova, Italy), R.Turolla.
Nuovo Cimento C (Italy), vol.5C, ser.1, no.5, p.507-14 (Sept.-Oct. 1982). [received: May 1983]
Devices exploiting nuclear resonances are believed to be very promising in detecting weak gravitational-wave perturbations. The main difficulty with these systems is that the high-energy photons which induce the nuclear transitions need to travel over distances comparable with the gravitational wave wave-lengths (~100 km). It is shown that if these high-energy photons are not produced by nuclear de-excitation but by inverse Compton scattering of laser light with ultra relativistic electrons, a deviation from the resonant frequencies of the order of the gravitational wave amplitude is still attained without the photon travel time being comparable with the gravitational-wave periods. (12 refs.)

05.00 STATISTICAL PHYSICS AND THERMODYNAMICS

(see also 02.50 Probability theory, stochastic processes, and statistics)

05.20 STATISTICAL MECHANICS

On one method of approximate solution of the Liouville equations ....See Entry 69909
Statistical physics: some basic principles of fluctuation and noise theory ....See Entry 69981
Microcanonical Monte Carlo simulation ....See Entry 69997
Statistical mechanics of one-dimensional systems. III. Multicomponent gas with Kac's potential ....See Entry 71678

05.30 QUANTUM STATISTICAL MECHANICS

(see also 67. Quantum fluids, and 71. Electron states in condensed matter)

69974 Deterministic model of spin and statistics. I.Pitowsky (Dept. of Philosophy, Univ. of Western Ontario, London, Ontario, Canada).
Phys. Rev. D (USA), vol.27, no.10, p.2316-26 (15 May 1983).
A deterministic model that accounts for the statistical behavior of random samples of identical particles is presented. The model is based on some nonmeasurable distribution of spin values in all directions. The mathematical existence of such distributions is proved by set-theoretical techniques, and the relation between these distributions and observed frequencies is explored within an appropriate extension of probability theory. The relation between quantum mechanics and the model is specified. The model is shown to be consistent with known polarization phenomena and the existence of macroscopic magnetism. Finally the possibility of a thought experiment which indicates a deviation from the predictions of quantum mechanics is described. (11 refs.)

69975 Energy inequalities $\binom{N}{2}^{-1}E_N<\binom{K}{2}^{-1}E_K$, $2<K<N$, relating two systems of identical bosons. R.L.Hall (Dept. of Math., Concordia Univ., Montreal, Quebec, Canada).
Phys. Rev. D (USA), vol.27, no.10, p.2379-82 (15 May 1983).
Suppose E_N is the lowest energy of a translation-invariant system of N identical bosons which interact by attractive central pair potentials and obey nonrelativistic quantum mechanics. Sufficient conditions are prescribed on the potential to prove that E_N is bounded above by $\binom{N}{2}\binom{K}{2}^{-1}E_K$, where $N\geq\mu K$. The μ numbers are specified for various classes of potential shape. In cases where $\mu\leq{}^3/_2$, it follows that $E_N\leq{}^1/_2N(N\text{-}1)E_2$ for $N\geq3$. (7 refs.)

69976 A new integral equation for Fermi systems—the superposition approximation and its extension to calculation of the two-body correlation function. Li Tiecheng (Inst. of Phys., Acad. Sinica, Beijing, China), Lin Peiwen.
Sci. Sin. (China), vol.26, no.4, p.402-11 (April 1983).
A new integral equation for the two-body correlation function is derived for Fermi systems in the framework of correlated basis-function. The exchange characteristics of fermions are considered in detail according to the topological structure at the vertices of correlation bonds. The only approximation used is the Kirkwood superposition approximation and its extension. Since decomposition into various exchange parts is known, the three forms of the kinetic energy test can be obtained in this new Chakravarty-Woo formalism (1978). (12 refs.)

69977 General Hartree-Fock solutions for a one dimensional δ-function gas. B.Sykja, J.-L.Calais (Quantum Chem. Group, Univ. of Uppsala, Uppsala, Sweden).
Theor. Chim. Acta (Germany), vol.62, no.5, p.429-42 (1983).
The one dimensional fermion gas with δ-function interactions is studied within the General Hartree-Fock (GHF) framework. Solutions of the eight Fukutome types are constructed by pairing and the corresponding gap equations are solved. The character of the solutions is studied as a function of the particle density. (33 refs.)

Statistical inference and distance between states in quantum mechanics ....See Entry 69905
Quantum Brownian motion ....See Entry 69996

05.40 FLUCTUATION PHENOMENA, RANDOM PROCESSES, AND BROWNIAN MOTION

69978 Optimal parameter identification for a linear system excited by Gaussian noise. F.Brodeau (Lab. IMAG, Univ. de Grenoble II, Grenoble, France).
Ann. Inst. Henri Poincare Sect. B (France), vol.19, no.2, p.123-52 (1983). In French.
This paper is concerned with the problem of parameter estimation in a system modelled by a scalar linear stochastic differential equation excited by Gaussian noise when controls of feedback type are used. Parameters in the noise being known, it is shown, for two controls, a step one, and a markovian one, that the drift parameters are identifiable by a family of maximum likehood estimates which is consistent and asymptotically normally distributed. For that aim existence of stationary solutions of the differential equation is proved. Further it is shown that each control is optimal for large classes of controls with respect to a criterion based on the information matrix. (11 refs.)

69979 Local nondeterminism and local times of general stochastic processes. S.M.Berman (Courant Inst. of Math. Sci., New York Univ., New York, NY, USA).
Ann. Inst. Henri Poincare Sect. B (France), vol.19, no.2, p.189-207 (1983).
Let $X(t)$, $0\leq t\leq1$, be a real stochastic process, and let $g(t)$, $0\leq t\leq1$, be a nonnegative integrable function. $X(t)$ is said to be locally g-nondeterministic if for every $k\geq2$, there exists $c_k>0$ such that the joint density of the $k-1$ increments, $X(t_{j+1})-X(t_j)$, $j=1, \ldots, k-1$, $t_1<\ldots<t_k$, evaluated at the origin, is bounded above by $c_kg(t_2-t_1)\ldots g(t_k-t_{k-1})$. This condition implies the validity of key estimates in the analysis of the local time of the process. The latter imply specific irregularity properties of the sample functions. Such properties have been studied for several years in the context of Gaussian processes. The contribution of this work is the demonstration that local nondeterminism can be usefully defined even for processes that are not necessarily Gaussian, and that the comprehensive theory of sample function irregularity for the latter processes can be extended to more general processes. Applications to Markov processes are exhibited. (20 refs.)

69980 Markov properties of $\mathbf{R}^2$ processes. M.Dozzi (Dept. de Statistique Math., Univ. de Berne, Berne, Switzerland).
Ann. Inst. Henri Poincare Sect. B (France), vol.19, no.2, p.209-21 (1983). In French.
Markov properties of stochastic processes (X_z; $z\epsilon\mathbf{R}^2$ (or $z\epsilon\mathbf{Z}^2$)) are considered. Emphasis is on two-parameter analogies of the following local Markov property: (Y_t; $t_0<t<t_1$) is conditionally independent of (Y_t; $t<t_0$ or $t>t_1$) given (Y_{t0}, Y_{t1}) for processes (Y_t; $t\epsilon\mathbf{R}$). In particular, the stationary Gaussian processes X, satisfying a local Markov property, are characterized. (10 refs.)

69981 Statistical physics: some basic principles of fluctuation and noise theory. N.Pacilio, M.Ciofalo (Dipartimento Reattori Veloci, Univ. degli Studi, Roma, Italy), M.Cirillo, R.Conversano, L.Magri, C.Napolitano, C.Trozzi, R.Vaccaro, V.Violante.
Ann. Nucl. Energy (GB), vol.10, no.6, p.305-17 (1983).
The authors propose a method for setting the fundamentals of fluctuation and noise theory in the framework of statistical mechanics; the emphasis is on describing the structural characteristics of some mathematical models of a stochastic nature. (16 refs.)

69982 Singular perturbation expansion for Markovian master equations. Ding E Jiang (Dept. of Phys., Liaoning Univ., China).
Commun. Theor. Phys. (China), vol.1, no.1, p.37-48 (1982).
Asymptotic properties of the master equations for chemical reactive systems whose macroscopic rate equations have more than one stationary state are discussed using generating function method. The systematic singular perturbation expansion method for equation of generating function is generalized to include the case of multistationary system beyond the bifurcation point. (13 refs.)

69983 Hierarchy of chaotic bands and periodicities embedded in them in a forced nonlinear oscillator. Hao Bai-lin, Zhang Shu-yu (Faculte des Sci., Univ. Libre de Bruxelles, Bruxelles, Belgium).
Commun. Theor. Phys. (China), vol.1, no.1, p.111-15 (1982).
Secondary direct and inverse bifurcation sequences exist in the chaotic bands of the primary inverse sequence. In the secondary chaotic bands periodicities of the tertiary sequences appear. This has been shown numerically in the forced Brusselator. (10 refs.)

69984 The rate of absorption of Brownian particles by a sphere. S.Harris (Coll. of Engng. & Appl. Sci., State Univ. of New York, Stony Brook, NY, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4698-700 (1 April 1983).
The author considers the solution of the Fokker-Planck equation for the case where a uniform dilute system of Brownian particles filling the volume $r>R$ is absorbed at the boundary $r=R$ for times $t>0$. An approximate solution is obtained for this time-dependent problem by using the lowest order terms in a half-range moment expansion of the Brownian particle distribution function. The solution obtained is used to examine the validity of Fick's law and to find the rate coefficient for the absorption process. This latter result is compared with the result found using the diffusion equation solution together with Fick's law. The author finds that the rate coefficient can be substantially smaller than the result predicted by the diffusion equation; this conclusion is a general agreement with earlier results for a related steady-state problem. (7 refs.)

69985 Voronoi cell properties from simulated and real random spheres and points. H.G.Hanson (Dept. of Phys., Univ. of Minnesota, Duluth, MN, USA).
J. Stat. Phys. (USA), vol.30, no.3, p.591-605 (March 1983).
Results are reported of a computer-aided study of the properties of Voronoi cells generated from randomly placed impenetrable uniform spheres which saturate a space and of Poisson points in three-dimensional space. An empirical expression is suggested for the volume distribution function and an expression for the probability of the nth nearest neighbor of a Voronoi cell nucleus forming a cell face. Comparison is made with the work of Meijering (1953), Finney (1970), Kiang (1966), and others. Radial distributions, coordination number, and packing density are discussed for the spheres. (37 refs.)

69986 On the linearization of nonlinear Langevin-type stochastic differential equations. M.C.Valsakumar, K.P.N.Murthy, G.Ananthakrishna (Reactor Res. Centre, Kalpakkam, India).
J. Stat. Phys. (USA), vol.30, no.3, p.617-31 (March 1983).
The authors show that a logical extension of the piecewise optimal linearization procedure leads to the Gaussian decoupling scheme, where no iteration is required. The scheme is equivalent to solving a few coupled equations. The method is applied to models which represent (a) a single steady state, (b) passage from an initial unstable state to a final preferred stable state by virtue of a finite displacement from the unstable state, and (c) a bivariate case of passage from an unstable state to a final stable state. The results are shown to be in very good agremeent with the Monte Carlo calculations carried out for these cases. The method should be of much value in multidimensional cases. (13 refs.)

69987 Approximate Gaussian representation of evolution equations. I. Single degree of freedom nonlinear equations. B.J.West (Center for Studies of Nonlinear Dynamics, La Jolla Inst., La Jolla, CA, USA), G.Rovner, K.Lindenberg.
J. Stat. Phys. (USA), vol.30, no.3, p.633-48 (March 1983).
The authors have developed a generalization of the method of statistical linearization to enable us to describe transient and other nonstationary phenomena obeying stochastic nonlinear differential equations. This approximation technique provides an optimal Gaussian representation with time-

dependent parameters. The algorithm specifies a set of ordinary differential equations for the Gaussian parameters in terms of the time-dependent average nonlinearities. They apply the general formalism developed herein for single degree of freedom dissipative systems to a particular example. (24 refs.)

69988 Analytic study of power spectra of the tent maps near band-splitting transitions. H.Shigematsu, H.Mori, T.Yoshida, H.Okamoto (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
J. Stat. Phys. (USA), vol.30, no.3, p.649-79 (March 1983).
Successive band-splitting transitions occur in the one-dimensional map $x_{i+1}=g(x_i)$, $i=0, 1, 2,...$ with $g(x)=\alpha x$, $(0\leq x\leq 1/2)-\alpha x+\alpha$, $(1/2<x\leq 1)$ as the parameter α is changed from 2 to 1. The transition point from $N(=2^n)$ bands to $2N$ bands is given by $\alpha=(\sqrt{2})^{1/N}$ $(n=0, 1, 2,...)$. The time-correlation function $\xi_i\equiv\langle\delta x_i\delta x_0\rangle/\langle(\delta x_0)^2\rangle$, $\delta x_i\equiv x_i-\langle x_i\rangle$ is studied in terms of the eigenvalues and eigenfunctions of the Frobenius-Perron operator of the map. The asymptotic expression for ξ_i has been obtained by deriving an analytic form of ξ_i for a sequence of α which accumulates to $\sqrt{2}$ from the above. Near the transition point $\alpha=(\sqrt{2})^{1/N}$, the damping constant of ξ_i for $i\geq N$ is given by $\gamma_N=\sqrt{2}(\alpha^N-\sqrt{2})/N$. Numerical calculation is also carried out for arbitrary α and is shown to be consistent with the analytic results. (32 refs.)

69989 Statistical mechanics and population biology. L.Demetrius (Max-Planck-Inst. fur Biophys. Chem., Gottingen, Germany).
J. Stat. Phys. (USA), vol.30, no.3, p.709-53 (March 1983).
The paper exploits the connection between statistical mechanics and stochastic processes in order to derive a class of macroscopic observables for populations. The review treats the dynamics of populations in both constant and variable environments and derives in each case the thermodynamic analogs of the population parameters. (30 refs.)

69990 Phase transition in a four-dimensional random walk with application to medical statistics. O.E.Percus (Courant Inst. of Math. Sci., New York Univ., New York, NY, USA), J.K.Percus.
J. Stat. Phys. (USA), vol.30, no.3, p.755-83 (March 1983).
A random walk in a piecewise homogeneous medium can exhibit a variety of asymptotic behaviors. In particular, it may lodge strictly in one region or divide in probability among several. This will depend upon the parameters describing (a) the walk, (b) the interregion boundary, and (c) the initial location of the walk. The authors analyze from this point of view a special four-dimensional walk on an integer lattice with two homogeneous regions separated by a hyperplane of codimension 1. The walk represents a continuing sequence of clinical trials of two drugs of unknown success probabilities and the two regions represent the Bayes-derived criterion as to which drug to try next. The demarcation in the parameter space of success probabilities and initial coordinates between one- and two-region asymptotics is mapped out analytically in several special cases and supporting numerical evidence given in the general case. (11 refs.)

69991 A method of approximation of invariant measures for maps on the unit interval. D.P.K.Ghikas (Dept. of Theoretical Phys., Univ. of Patras, Patras, Greece).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.91-8 (March 1983).
A method is proposed for the construction of continuous functions approximating the density functions for invariant measures of a map on the unit interval. (15 refs.)

69992 Markov process and entropy associated to a reversible evolution. S.Martinez (Dept. de Matematicas, Univ. de Chile, Santiago, Chile), E.Tirapegui.
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.143-5 (25 April 1983).
The Markov process associated to a reversible evolution in recent works of the Brussels group is characterized. The evolution and entropy of states concentrated on stable and unstable manifolds is considered. (9 refs.)

69993 On the lifetime of a metastable state at low noise. B.J.Matkowsky, Z.Schuss (Dept. of Engng. Sci. & Appl. Math., Northwestern Univ., Evanston, IL, USA).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.213-15 (2 May 1983).
The mean lifetime of a metastable state of a dynamical system driven by small noise is calculated. The vector field of the dynamical system which need not be deriveable from a potential, is assumed to have a vanishing normal component on the boundary of the domain of attraction of the metastable state. (16 refs.)

69994 Similarity structure and scaling property of the period-adding phenomena. K.Kaneko (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.403-14 (Feb. 1983).
Period-adding sequence at the locking from torus to chaos is studied with the use of a one-dimensional mapping. Similarity and various scaling properties of each cycle are found numerically, which can be explained through a 'phenomenological theory' based on the existence of the fixed point function. The author classifies the sequence into three cases. The author also applies the theory to the case in which the sequence is a window among chaotic states. (19 refs.)

69995 Remarks on existence of noise-induced long-time tail. Y.Hamada (Inst. of Statistical Math., Tokyo, Japan), K.Muto.
Prog. Theor. Phys. (Japan), vol.69, no.2, p.451-63 (Feb. 1983).
Existence of noise-induced long-time tail (critical slowing down) is studied. Exact analytic solution of the stochastic differential equation $DX_t=(\gamma X_t-X_t^n)dt+X_t\circ dW_t$, where W_t is the Wiener process, is confirmed by solving the hierarchy equations of moments $\langle X_t^p\rangle$. A simple derivation procedure gives the same results as those obtained by Suzuki et al. (1982) and Brenig and Banai (1982). A transition probability density function corresponding to the stochastic differential equation is also derived. The moments $\langle X_t^p\rangle$ are alternatively described with the help of the transition probability density function. It is revealed, by numerical integrals, that the first few moments behave as $t^{-1/2}$ for large t. Monte Carlo simulations of the stochastic differential equation also confirm the occurrence of the noise-induced long-time tail. The numerical calculations are made in the case $n=3$. (13 refs.)

69996 Quantum Brownian motion. H.Grabert (Inst. fur Theoretische Phys., Univ. Stuttgart, Stuttgart, Germany), P.Talkner.
Phys. Rev. Lett. (USA), vol.50, no.18, p.1335-8 (2 May 1983).
A new master equation describing the irreversible process of a quantum mechanical Brownian particle is proposed. The master equation is shown to obey the symmetry of detailed balance leading to a quantum analog of the reciprocity relations, and the fluctuation-dissipation theorem is obtained. The method is applied to the damped harmonic oscillator. The relation to previous approaches is discussed. (7 refs.)

69997 Microcanonical Monte Carlo simulation. M.Creutz (Dept. of Phys., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1411-14 (9 May 1983).
A new algorithm for the simulation of statistical systems is presented. The procedure produces a random walk through configurations of a constant total energy. It is computationally simple and applicable to systems of both discrete and continuous variables. (8 refs.)

69998 Photon correlation spectroscopy of the nonMarkovian-Brownian motion of spherical particles. K.Ohbayashi, T.Kohno, H.Utiyama (Faculty of Integrated Arts & Sci., Hiroshima Univ., Hiroshima, Japan).
Phys. Rev. A (USA), vol.27, no.5, p.2632-41 (May 1983).
The nonMarkovian-Brownian motion was studied by photon correlation spectroscopy on spherical particles suspended in viscous fluid. The nonMarkovian property has been expected to give rise to a long-time tail proportional to $t^{-3/2}$ in the velocity correlation function and, correspondingly, a term of the form $p_{1/2}t^{1/2}$ in the argument of the exponential function of the photon correlation spectroscopy. Measurements were done on polystyrene latex spheres of 0.804-μm diameter suspended in pure water. Results of the experimental determination of the coefficient $P_{1/2}$ at three different temperatures were 0.397 ± 0.035 $s^{-1/2}$ at 32.8°C, 0.326 ± 0.029 $s^{-1/2}$ at 28.0°C, and 0.267 ± 0.27 $s^{-1/2}$ at 23.5°C, the corresponding theoretical values being 0.409, 0.346, and 0.293 $s^{-1/2}$, respectively. Thus there is good agreement between the experimental values and the theoretical predictions. (32 refs.)

69999 Numerical evaluation of path-integral solutions to Fokker-Planck equations. M.F.Wehner, W.G.Wolfer (Nuclear Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2663-70 (May 1983).
A numerical method, based on the path-integral formalism, is presented to solve nonlinear Fokker-Planck equations with natural boundary conditions. For one-dimensional stochastic processes, several specific examples possessing exact analytic solutions are evaluated numerically for purposes of comparison. Various discretization prescriptions are investigated and found to be equivalent as expected. The numerical method is shown to give accurate results provided the spatial discretization and the time step satisfy certain relationships determined by the drift and the diffusion functions of the nonlinear Fokker-Planck equations. (26 refs.)

70000 New type of 'crisis' showing hysteresis. Y.Yamaguchi, K.Sakai (Dept. of Phys., Sci. Univ. of Tokyo, Tokyo, Japan).
Phys. Rev. A (USA), vol.27, no.5, p.2755-8 (May 1983).
A new type of 'crisis' is found in a quadratic logistic map with periodic modulation. This shows a hysteresis followed from coexistence of two attractors. It is also shown that crises are characterized by discontinuous changes in the power spectrum and Lyapunov number. (18 refs.)

70001 Corrections to scaling in self-avoiding walks. S.Havlin, D.Ben-Avraham (Dept. of Phys., Bar-Ilan Univ., Ramat-Gan, Israel).
Phys. Rev. A (USA), vol.27, no.5, p.2759-62 (May 1983).
Corrections to scaling, as well as the critical exponent ν, are calculated for self-avoiding walks, with the use of a new highly accurate method based on fractal dimensionality. Numerical results are obtained for 2, 3, 4, and 5 dimensions and are shown to be in excellent agreement with the prediction of the $n=0$ vector model. (20 refs.)

70002 Intermittency—another route to chaos. D.J.Scalapino (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA), J.E.Hirsch, B.A.Huberman.
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.243-57
The period-doubling or pitchfork bifurcation route to chaotic behavior of one-dimensional maps has been extensively studied. The authors review another route to chaotic behavior which occurs via intermittency. Near a tangent bifurcation, a one-dimensional map can exhibit long, regular sequences separated by irregular bursts. The authors illustrate this phenomena of intermittency using the logistic map. They then discuss how the average length of the regular regions scales with the parameter which controls how close the system is to the point of tangent bifurcation and also how it depends upon an applied stochastic noise. They conclude with a discussion of a renormalization group formulation of the problem of intermittency which illustrates the important ideas of universality. (20 refs.)

Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium .... See Entry 69788

A probabilistic derivation of the stability condition of the difference equation for the diffusion equation .... See Entry 69829

Stochastic linear maps and transition probability .... See Entry 69919

Critical behavior of a KAM surface. II. Renormalization approach .... See Entry 70025

Aspects of supersymmetric quantum mechanics .... See Entry 70243

Effects of interfacial transport on the equilibrium fluctuations in fluid layers .... See Entry 71512

Modeling of mass-exchange processes taking into account fluctuations of the physicochemical parameters .... See Entry 71635

Effect of sedimentation on Taylor diffusion .... See Entry 73375

Mossbauer absorption in overdamped harmonically bound particles in Brownian motion .... See Entry 73507

05.50 LATTICE THEORY AND STATISTICS; ISING PROBLEMS

(see also 75.10H Ising models)

70003 Vectorial measures on vector lattices. H.Heinich (Lab. de Probabilites, Univ. Pierre et Marie Curie, Paris, France).
Ann. Inst. Henri Poincare Sect. B (France), vol.19, no.2, p.153-74 (1983). In French.
The purpose of this article is to show that for a sufficiently large class of non topological vector lattices, the order properties on real measures hold also for vector-valued signed measures. For this the author introduces the notion of *l-s* space whose positive linear forms verify a local condition of homomorphism and of sequential continuity with respect to order. After having classifical certain sets of measures he establishes for *l-s* spaces the inequalities of Chacon and the convergence of sub-additive processes as well as those of simple martingales. A second localization procedure—using the notion of 'order point'—allows him to reduce most classical spaces (lattices) to the former case. Finally he gives a version of the above properties for vector-valued random variables. (13 refs.)

70004 Percolation with 3-body or next nearest neighbor correlations. Li Tie-cheng (Inst. of Phys., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.65-8 (Jan.-March 1983). [received: May 1983]
The percolation problem for the 2-D triangular lattice of the quenched-correlated system is studied by using a real-space renormalization-group method. The many-body correlations for the occupied sites are considered by

Kirkwood's superposition approximation approach and those for occupied and unoccupied sites by a procedure which holds the conservation of probability. The scheme is applied to the case including 3-body correlation and to that with next nearest neighbor correlations. The author's conclusion is that, in either case the universality in critical phenomena of percolation is unchanged, even some complicated correlations are involved. (9 refs.)

70005 On states, on a lattice, with half-integral charge. J.S.Bell (CERN, Geneva, Switzerland), R.Rajaraman.

Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.1-12 (16 May 1983).

In certain molecular models, and related one-dimensional field theories, localized objects appear with half-integral expectation values of charge. The authors consider whether these states are eigenstates of charge, with half-integral eigenvalue. They find that it is indeed so for a suitably diffuse definition of the charge operator in question. This diffuse charge operator has a spectrum which approaches a continuum. The analysis is made on a lattice to avoid divergence ambiguities, and on a finite length, which is only subsequently made large. The half-integral charge phenomenon is not tied to solitons, but can also arise as an end effect. (14 refs.)

70006 Quantum inverse scattering method and the diagonal-to-diagonal transfer matrix of vertex models. T.T.Truong (Inst. fur Theoretische Phys., Freie Univ. Berlin, Berlin, Germany), K.D.Schotte.

Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.77-101 (16 May 1983).

The authors discuss a construction of Bethe ansatz eigenstates for the so-called diagonal-to-diagonal transfer matrix of two-dimensional vertex models on a square lattice, recently introduced by Bariev (1981, 1982). They show that the basis of the method again lies in the 'triangle equations' of the vertex model and construct a corresponding quantum inverse scattering method which can be generalised to Kagome and triangular lattices. (15 refs.)

70007 Self similarity and correlations in percolation. A.Kapitulnik, A.Aharony, G.Deutscher, D.Stauffer (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel).

J. Phys. A (GB), vol.16, no.8, p.L269-74 (1 June 1983).

The infinite cluster above the percolation threshold is shown by a scaling theory and Monte Carlo simulations to be homogeneous on large length scales (compared with the correlation length). On shorter length scales this cluster is self similar, and its measured fractal dimensionality agrees excellently with the scaling law $D=d-\beta/\nu$. The exponents β and ν are also measured, both from the crossover between the two length scale regions and from correlations near the boundaries. (18 refs.)

70008 Branched polymers with a prescribed number of cycles. S.G.Whittington (Dept. of Chem., Univ. of Toronto, Toronto, Ontario, Canada), G.M.Torrie, D.S.Gaunt.

J. Phys. A (GB), vol.16, no.8, p.1695-711 (1 June 1983).

The authors consider the number of lattice animals with exactly c cycles. For weakly embeddable (bond) clusters they show rigorously that the growth constant is independent of c and they derive upper and lower bounds on the critical exponents for each value of c. They use series analysis methods to estimate the critical exponents for $c=1$ and 2 in two and three dimensions and find that the critical exponent does depend on the number of cycles. Evidence from series analysis results and from expansions in inverse powers of the dimension suggests that, in the case of strong embeddings (i.e. site clusters) the growth constant is independent of c and the corresponding values of the critical exponents are identical to the values for weak embeddings (i.e. bond clusters). They discuss the relationship of these results to the field theory prediction that the critical exponent is independent of cycle fugacity. (17 refs.)

70009 Influence of the reaction field on the nature of the phase transition in the Potts model. R.Dekeyser (Inst. voor Theoretische Fysika, Katholieke Univ. Leuven, Heverlee, Belgium), A.Maritan, A.L.Stella.

J. Phys. A (GB), vol.16, no.8, p.1713-20 (1 June 1983).

It is shown how Onsager's reaction field may be incorporated in mean-field-like calculations for the q-state Potts model. Its influence on the nature of the phase transition is considered both in a one-site and a two-site cluster approximation. Considerable improvement is obtained for $q_c(d)$, the value which separates first- and second-order transitions. The way in which $q_c(d)$ is modified when a second-neighbour interaction is added to the ferromagnetic nearest-neighbour one is also studied. (18 refs.)

70010 Non-universal corrections to scaling for a lattice model. C.Smith (Dept. of Phys., Univ. of Edinburgh, Edinburgh, Scotland).

J. Phys. A (GB), vol.16, no.8, p.1771-94 (1 June 1983).

A field theoretic model derived from a lattice spin model is studied within the framework of the renormalisation group. To second order in $\epsilon=4-d$, where d is the dimensionality of the lattice, the non-universal fixed point and the amplitude of the leading correction to scaling for the susceptibility are determined for two types of lattice. The functional form obtained for the amplitude compares qualitatively well with high-temperature series work; in particular, it gives a prediction for the amplitude of corrections to scaling for the spin-$^1/_2$ Ising model on a body centred cubic lattice in three dimensions that is in fair numerical agreement with high temperature series estimates. (18 refs.)

70011 Droplet theory in low dimensions: Ising systems in zero field. A.D.Bruce, D.J.Wallace (Dept. of Phys., Univ. of Edinburgh, Edinburgh, Scotland).

J. Phys. A (GB), vol.16, no.8, p.1721-69 (1 June 1983).

The authors develop a theory of the universal configurational physics underlying critical point phenomena in the Ising universality class. The theory is formally justifiable in $d=1+\epsilon$ dimensions and may be regarded as the natural continuation of the kink-based theory of one dimension, which it incorporates as a limiting case. In $d=1+\epsilon$ the configurational building block is the droplet. The typical droplet is not spherical and the many-droplet assembly is not dilute: the implied problems are handled with renormalisation group methods. It is found that droplet shape fluctuation effects control the correlation length exponent ν, while the nesting of droplets within droplets control the order parameter exponent β. The exponents ν and β thus effectively define, respectively, the fractal dimensions of the droplet surface and the droplet volume. The theory is used to determine and illuminate the critical behaviour of further quantities including the free energy, the susceptibility, the droplet number distribution and the distribution of the intra-droplet order. (61 refs.)

70012 Theory of the phase boundary for cubic Ising lattices with pair-quartet interactions. B.Frank (Dept. of Phys., Concordia Univ., Montreal, Quebec, Canada), O.G.Mouritsen.

J. Phys. C (GB), vol.16, no.13, p.2481-96 (10 May 1983).

A theory is presented for the determination of the transition temperature T_c for spin-$^1/_2$ Ising models on cubic lattices with pair (J_2) and quartet (J_4) interactions. A linear relationship between T_c and J_4/J_2 is found to have a base wider in scope than that of previous theories. The calculation of the linear coefficient is performed through the derivation of a new equation for special four-spin correlation functions which is solved in a novel way by the use of a ratio approximation. The results are compared with those derived from previous theories, series analysis and Monte Carlo calculations which are also presented here. The linear coefficient is shown to depend on a parameter which turns out to have approximately the same value for all cubic lattices, thus suggesting a set of scaled variables in terms of which the phase boundary for all cubic lattices may be fitted by a common curve. From the authors' work a coherent picture emerges for the phase behaviour of cubic Ising lattices with pair and quartet interactions, involving regions of continuous and first-order transitions separated by a tricritical point which occurs at the same value of the scaled variables for all cubic lattices. (26 refs.)

70013 Exact models with a complete Devil's staircase. S.Aubry (Center for Nonlinear Studies, Los Alamos Nat. Lab., Los Alamos, NM, USA).

J. Phys. C (GB), vol.16, no.13, p.2497-508 (10 May 1983).

The author describes two exact models which exhibit a complete Devil's staircase which can both be calculated explicitly with the same method. The first one is a discrete Frenkel-Kontorova model (an elastic chain of atoms submitted to a continuous piecewise parabolic periodic potential). The atomic mean distance of the ground state varies with the model parameters as a complete Devil's staircase. The authors also calculates explicitly the Peierls-Nabarro barrier and the depinning force of the chain which is always locked on the periodic potential. (However, it is noted that the lack of differentiability of this periodic potential always makes the chain locked and the Devil's staircase complete, unlike the case for smooth periodic potentials.) The second model is the Ising chain under an external magnetic field and with long-range antiferromagnetic interactions proposed by Bak and Bruinsma (1982). It is rigorously proved that the ground state of this model is periodically modulated and that its magnetisation varies as a function of the magnetic field which is a complete Devil's staircase. This one is also explicitly calculated. (17 refs.)

70014 Convexity violations for noninteger parameters in certain lattice models. R.B.Griffiths, P.D.Gujrati (Dept. of Phys., Carnegie-Mellon Univ., Pittsburgh, PA, USA).

J. Stat. Phys. (USA), vol.30, no.3, p.563-89 (March 1983).

The convexity of the free energy is studied for several lattice models in situations in which a parameter which is normally a positive integer takes on noninteger real values. Examples include the number n of components in the n-vector model, the number of states in the Potts model, and the dimensionality of the lattice. In a typical case there is a critical value of the parameter such that convexity is preserved when the parameter exceeds the critical value, but can be violated for appropriate Hamiltonians whenever the parameter is less than the critical value, but not a positive integer. In several cases the critical value of the parameter increases with the size of the systems, thus raising questions about the significance of a continuous variation of the parameter in the thermodynamic limit. (27 refs.)

70015 On the method of Symes for integrating systems of the Toda type. V.Guillemin (MIT, Cambridge, MA, USA), S.Sternberg.

Lett. Math. Phys. (Netherlands), vol.7, no.2, p.113-15 (March 1983).

Let $G=KL$ and $g=k+l$ be Lie group and Lie algebra decompositions. This identifies k^0 with l^*. The authors prove a formula which says that the integral curve through $\alpha\in k^0$ is obtained as $b(t)\alpha$, where $\alpha(t)=\exp t\xi$ with $\xi=L_f(\alpha)$, and $a(t)=b(t)c(t)$, and where $L_f:g^*\to g$ is the Legendre transform. This generalizes a formula of Symes (1980) for the generalized Toda lattice. (10 refs.)

70016 Higher order calculations for *d*-dimensional lattice with *d′*-dimensional defect. R.Abe (Dept. of Pure & Appl. Sci., Univ. of Tokyo, Tokyo, Japan), K.Yamamoto, K.Ideura.

Prog. Theor. Phys. (Japan), vol.69, no.2, p.464-79 (Feb. 1983).

Using $1/n$ expansion, the n-vector model in a d-dimensional lattice is studied where a d-dimensional defect exists. Previous theories which dealt with the $n\to\infty$ limit are extended up to the order λ/n (λ: a parameter specifying the strength of defect). The pair correlation function in the defect space is discussed for the three-dimensional lattice. A critical exponent $\eta_\parallel$ pertaining to the critical correlation is calculated up to the same order. (17 refs.)

70017 Solution of operator field equations by the method of finite elements. C.M.Bender (Dept. of Phys., Washington Univ., St. Louis, MO, USA), D.H.Sharp.

Phys. Rev. Lett. (USA), vol.50, no.20, p.1535-8 (16 May 1983).

A method is proposed for the approximate numerical solution of operator field equations on a lattice. (4 refs.)

70018 Description of the phase with broken symmetry in the Ising model by the method of quasi-averages. Yu.P.Virchenko (Physicotech. Inst., Acad. of Sci., Kharkov, Ukrainian SSR).

Theor. & Math. Phys. (USA), vol.52, no.3, p.927-38 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.473-90 (Sept. 1982). [received: May 1983]

A system of equations for the correlation functions of the Ising model is obtained. It is shown that this system of equations is solvable at a sufficiently low temperature and a rapidly converging iterative procedure is constructed which makes it possible to calculate with arbitrarily high accuracy the equation of state and the correlation functions of the Ising model. The first terms of the perturbation theory series are given. (10 refs.)

Linearization of nonlinear differential-difference equations ......See Entry 69861

Microcanonical Monte Carlo simulation ....See Entry 69997

A Monte Carlo study of the entropy, the pressure, and the critical behavior of the hard-square lattice gas ....See Entry 70023

Critical behavior of a KAM surface. II. Renormalization approach ....
....See Entry 70025

How well do Monte Carlo simulations distinguish between U(1) and SU(2)? A study of the string tension in U(1) lattice gauge theory .... See Entry 70174

Boost operator and its application to quantum Gelfand-Levitan equation for Heisenberg-Ising chain with spin one-half ....See Entry 72574

Equilibrium polymerization in two dimensions ....See Entry 73334

05.60 TRANSPORT PROCESSES: THEORY

70019 Exact stationary solutions of kinetic equations describing particle coalescence. L.I.Vinokurov, O.V.Kats.

Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.55-7 (1983). In Ukrainian.

Power, mass and momentum distributions resulting from particle collision with coalescence in the presence of a source and sink are obtained as exact stationary solutions of the kinetic equation. The collision integral symmetry for uniform probability of the general transition is used as in the theory of weak turbulence. The transition to the coagulation equation is made by averaging of the kinetic equation for momenta and the corresponding mass distributions are obtained. Dust particle coalescence in space which presents a practical interest is considered as a particular example. Locality of the distributions formed is investigated. (12 refs.)

70020 Film models for multicomponent mass transfer: a statistical comparison. L.W.Smith (Indiana Inst. of Technol., Fort Wayne, IN, USA), R.Taylor.
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.1, p.97-104 (Feb. 1983).
The rates of multicomponent mass transfer predicted from several approximate solutions of the Maxwell-Stefan equations for a film model of steady-state diffusion are compared with the fluxes calculated from an exact solution for many hundreds of thousands of example problems. It is found that the assumption that the matrix of multicomponent diffusion coefficients remains constant is an excellent one and that the solution of the linearized equations due to H.L. Toor (1964) and to W.E. Stewart and R. Prober (1964) always provides adequate estimates of the mass-transfer rates. The method of R. Taylor and L.W. Smith (1982) is the better of two explicit methods, bettering even the solution of the linearized equations in a number of cases. (49 refs.)

70021 The one-dimensional diffusion process and unitary representations of R^1. M.P.Heble (Dept. of Math., Univ. of Toronto, Toronto, Canada).
J. Math. Anal. & Appl. (USA), vol.93, no.2, p.363-84 (May 1983).
Given a cocycle $a(t)$ of a unitary group $\{U^t\}$, $-\infty<t<\infty$, on a Hilbert space $\mathcal{H}$, such that $a(t)$ is of bounded variation on $[0,T]$ for every $T>0$, $a(t)$ is decomposed as $a(t)=\int_0^t U^s x\, ds+\beta(t)$ for a unique $x\in\mathcal{H}$, $\beta(t)$ yielding a vector measure singular with respect to Lebesgue measure. The variance is defined as $\sigma^2(\{U^t\}, a(t))=\lim_{T\to\infty}(1/T)\|\int_0^t U^s x\, ds\|^2$ if existing. For a stationary diffusion process on R^1, with Ω_1 the space of paths which are natural extensions backwards in time, of paths confined to one nonsingular interval J of positive recurrent type, an information function $I(\omega)$ is defined on Ω_1 based on the paths restricted to the time interval $[0,1]$. It is shown that $I(\omega)$ is continuous and bounded on Ω_1. The shift τ_1 defines a unitary representation $\{U^t\}$. Assuming $\int_{\Omega 1} I\, dm=0$, dm being the stationary measure defined by the transition probabilities and the invariant measure on J, $I(\omega)$ has a C^∞ spectral density function f. It is then shown that $\sigma^2(\{U^t\},I)=f(0)$. (30 refs.)

70022 A new fourth-order finite-difference method for solving discrete-ordinates slab transport equations. B.Neta, H.D.Victory,Jr. (Dept. of Math., Texas Tech. Univ., Lubbock, TX, USA).
SIAM J. Numer. Anal. (USA), vol.20, no.1, p.94-105 (Feb. 1983).
A theoretical study is made of a new fourth-order finite-difference scheme for spatially discretising the discrete-ordinates equations for solving numerically the slab transport (Boltzmann) equation. This analysis considers the quadratic continuous method, whose derivation parallels that of the commonly used diamond difference and linear discontinuous schemes from balance equations for particle conservation across a spatial cell. A convergence analysis of this method is provided and it is proven that superconvergence phenomena are present for cell-edge and cell-average fluxes. Results from an S_2-test problem are also presented to show that the asymptotic convergence rates are observed on rather coarse spatial meshes. (10 refs.)

The rate of absorption of Brownian particles by a sphere .... See Entry 69984

Numerical evaluation of path-integral solutions to Fokker-Planck equations .... See Entry 69999

Application of the Ritz method in interrelated heat- and mass transfer problem solving .... See Entry 71337

Effects of interfacial transport on the equilibrium fluctuations in fluid layers ... . See Entry 71512

Mechanism of turbulent mass transfer at a solid boundary ..... See Entry 71520

Mass transfer and free convection through a porous medium by the presence of a rotating fluid .... See Entry 71543

A thermodynamic development of generalized Fourier and Ohm conduction laws for anisotropic materials .... See Entry 72365

05.70 THERMODYNAMICS

(see also 44.60 Thermodynamic processes, 64. Equations of state, phase equilibria and phase transitions, 65. Thermal properties of condensed matter; for chemical thermodynamics, see 82.60)

70023 A Monte Carlo study of the entropy, the pressure, and the critical behavior of the hard-square lattice gas. H.Meirovitch (Chem. Phys. Dept., Weizmann Inst. of Sci., Rehovot, Israel).
J. Stat. Phys. (USA), vol.30, no.3, p.681-98 (March 1983).
An approximate technique for estimating the entropy S with computer simulation methods, suggested recently by Meirovitch (1977), is applied here to the Metropolis (1953) Monte Carlo (MC) simulation of the hard-square lattice gas in both the grand canonical and the canonical ensembles (1963). The chemical potential μ, calculated by Widom's (1963) method, and S enable one to obtain also the pressure P. The MC results are compared with results obtained with Pade approximants (PA) and are found to be very accurate. The author also calculates the critical exponents by applying Fisher's (1967) finite-size scaling theory to the results for the long-range order, the compressibility and the staggered compressibility, obtained for several lattices of different size at z_c. The data are consistent with the critical exponents of the plane Ising lattice $\beta=1/8$; $\nu=1$, $\gamma=7/4$, and $\alpha=0$. (49 refs.)

70024 The question of an upper bound on entropy. A.Qadir (Internat. Centre for Theoretical Phys., Trieste, Italy).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.285-6 (9 May 1983).
The author discusses the possibility, and significance, of an upper bound on entropy in the light of the arguments of Bekenstein (1982) and Unruh and Wald (1982). He obtains a stricter bound than Bekenstein does, and points out some limitations with regard to its significance. (6 refs.)

70025 Critical behavior of a KAM surface. II. Renormalization approach. L.P.Kadanoff (James Franck & Enrico Fermi Insts., Univ. of Chicago, Chicago, IL, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.209-41
Scaling and renormalization arguments are applied to critical KAM trajectories, which appear in the Chirikov-Taylor model (1979). The renormalization is constructed with the aid of a generating function, or action, and the renormalization equation is the principle of least action. After many renormalizations, the action is observed to achieve a scale invariant form. Fixed point equations, and then a fixed point for the action are constructed. Critical indices are evaluated which are in good agreement with previous work. However, numerical errors plus near marginality of the recursion relations permit a doubt about whether the formulation has been fully confined. (8 refs.)

Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium .... See Entry 69788

Comment on 'The concept of temperature and its dependence on the laws of thermodynamics' .... See Entry 69832

Existence of temperature and entropy of a continuous medium and its consequences on the elastic part of the stress tensor .... See Entry 69887

Initial states of maximal entropy in formal scattering theory . See Entry 69938

Entropy bounds and the second law for black holes .... See Entry 69950

Entropy bounds, acceleration radiation, and the generalized second law .... See Entry 69951

Theory of the phase boundary for cubic Ising lattices with pair-quartet interactions .... See Entry 70012

Convexity violations for noninteger parameters in certain lattice models .... See Entry 70014

Statistical mechanics of one-dimensional systems. III. Multicomponent gas with Kac's potential .... See Entry 71678

Melting, order, flows, mappings and chaos .... See Entry 72087

A thermodynamic development of generalized Fourier and Ohm conduction laws for anisotropic materials .... See Entry 72365

06.00 MEASUREMENT SCIENCE, GENERAL LABORATORY TECHNIQUES, AND INSTRUMENTATION SYSTEMS

06.20 METROLOGY

06.20D Measurement and error theory

Errors in planimetry .... See Entry 70031

Errors in measuring the relative coordinates of two reflectors .... See Entry 70032

Modulation error in determining polarization azimuth .... See Entry 70105

06.20F Units

Laser frequency measurements and the redefinition of the meter .... See Entry 70029

The NPL moving-coil ampere determination .... See Entry 70075

Realizing the ampere by levitating a superconducting mass—a suggested procedure .... See Entry 70076

The reproduction of the As-maintained unit of voltage at IEN by means of $2e/h$ .... See Entry 70079

06.20H Measurement standards and calibration

70026 Josephson volt standard at the National Physical Laboratory, New Delhi. N.S.Natrajan (Div. of Specialised Tech. Cryogenics, Nat. Phys. Lab., New Delhi, India).
Indian J. Cryog., vol.7, no.4, p.194-9 (1982).
A Josephson volt standard set up is almost in operation at the National Physical Laboratory, New Delhi, A cryostat holding a Josephson junction, a stabilised microwave system and an electronic biasing circuit have been prepared and these were tested at the Physikalisch-Technische Bundesanstal (PTB), Braunschweig, West Germany by the author. This paper describes in detail the construction of the cryostat, the assembling of the stabilised microwave system and the features of the electronic biasing circuit and how these could be utilised in the comparison of the Josephson voltage against the standard cell volt. Four standard cells in a commercial constant temperature enclosure have been compared against PTB volt standard and against the Josephson volt standard set up by the author at PTB and the results are given. The accuracy of the comparison with this Josephson volt standard set up is found to be of the order of a few parts in 10^7. (3 refs.)

70027 Relativistic effect on atomic clocks. Y.Saburi (Ministry of Posts & Telecommunications, Koganei, Japan).
J. Inst. Electron. & Commun. Eng. Jpn. (Japan), vol.66, no.1, p.60-3 (Jan. 1983). In Japanese.
As is known; if two observers, one at rest and the other moving with a constant velocity, measure the velocity of propagation of the same light beam, they both obtain the same value, c. In other words; the postulate of the invariance of length, time, mass and force has been replaced by the postulate of the invariance of the velocity of light. This postulate leads to the transformation of Lorentz. When time measurements are made on or near the Earth, the effect of revolution of the Earth on its axis and around the Sun should be taken into account. Principles and experiments of time correction for this are briefly described in this paper. It is shown that the correction can be made with an error within 0.1 to 1 ns. (7 refs.) *K.B.*

70028 A split second isn't fast enough. J.Pilkington (Royal Greenwich Astron., Hailsham, England).
Natl. Electron. Rev. (GB), vol.18, p.24-8 (1983).
It is now possible to keep time so accurately that it is possible to buy a fairly cheap wristwatch and say, with some justification, that it never goes wrong. But several professions need time-keepers more accurate than that by several orders of magnitude. Electronics is helping them achieve it. The author joined the Royal Greenwich Observatory in 1969 to work on astronomical instrumentation, and became head of the Time Department in 1976. He has worked in an international intergovernmental committee on the Definition of the Second. His main work at present is the satellite laser ranging facility at Herstmonceux which should become operational this year. He also describes both the quartz crystal clock and the Cs-beam resonance clock. (no refs.)

Merits and limitations of submillimeter wavelength frequency standards based on an Mg(Ca) metastable beam .... See Entry 70035

A new heart for Rb frequency standards?: the evacuated, wall-coated sealed cell .... See Entry 70036

Automated timekeeping. II .... See Entry 70038

A compact hydrogen maser with exceptional long-term stability [measurement standards] .... See Entry 70039

Performance of the four NRC long-beam primary cesium clocks Cs V, Cs VIA, Cs VIB, and CS VIC .... See Entry 70040

International intercomparison of electric-field strength at 100 MHz .... See Entry 70041

Pulsed magnetic field calibrations for transducers for rapidly changing pressures .... See Entry 70049

The maintenance and comparison of standards of electromotive force at the BIPM .... See Entry 70077

High-accuracy Josephson potentiometer [voltage standard] .... See Entry 70078

The reproduction of the As-maintained unit of voltage at IEN by means of 2e/h .... See Entry 70079

Point-contact Josephson voltage standard .... See Entry 70080

Standard magnetic field radiated by two loop antennas in a coplane .... See Entry 70089

The evolving problems in precise optical measurements .... See Entry 70095

Problems on luminance measurement and calibration of luminance meter .... See Entry 70102

Calibration of a mass spectrometer in static operation .... See Entry 70140

Progress in fiber test standards .... See Entry 71236

Method of obtaining stable flow rates in test systems .... See Entry 71670

Calibration of a jet flowmeter on a substitute liquid .... See Entry 71671

Plasma density measurements in a fast linear theta-pinch by absolute intensity measurements of bremsstrahlung .... See Entry 71793

06.30 MEASUREMENT OF BASIC VARIABLES

06.30C Spatial variables measurement

(inc. measurement of all variables extending in space e.g. diameter, height, thickness, displacement, surface topography, particle size, area of disperse systems)

70029 Laser frequency measurements and the redefinition of the meter. P.Giacomo (Internat. Bur. of Weights & Measures, Sevres, France).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.244-6 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
The use of an atomic wavelength to define the meter assumes the permanence and universality of the atomic energy levels, Planck's constant, and the speed of light. The new definition proposed for the meter is based upon the path length traveled by light in a specified duration. Limitations of the implementation of the new definitions are discussed. In early 1980s, very few determinations of visible frequencies have been performed that may claim an accuracy exceeding 10^9. Progress in this respect will open the way to an easier implementation of the new definition of the meter. It is also a key to extend to the IR and visible range the electromagnetic high-frequency techniques. Frequency standards in this range would then have a definite appeal. (no refs.)

70030 The eikonal approximation applied to sizing transparent fibres using the scattered intensity-ratio technique. S.K.Sharma, D.J.Somerford (Phys. Dept., Univ. Coll., Cardiff, Wales).
J. Phys. D (GB), vol.16, no.5, p.733-42 (14 May 1983).
The first-order corrected eikonal approximation (FCEA) has been used as an approximation to the exact theory for fibre size measurements by the forward lobe scattering intensity-ratio technique. Fibre diameters in the range 0.20-4.00 μm are considered. Intensity ratio curves are presented as a function of fibre size parameter at angle pairs 5°/2.5°, 10°/5° and 20°/10°. A comparison with similar curves based on the exact scattering theory has been made and the percentage error in size parameters obtained using FCEA has been tabulated for relative refractive indices $m=1.05$ and 1.15. (21 refs.)

70031 Errors in planimetry. E.V.Voinich, A.T.Lebedev, V.A.Novikov, L.P.Troshin, L.A.Baranov.
Meas. Tech. (USA), vol.25, no.8, p.636-8 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.16-17 (Aug. 1982). [received: April 1983]
It is common practice to use planimeters to determine the areas of diagrams drawn by pen recorders in order to calculate overall or mean values. Statistical analysis of the instrumental errors, errors caused by the individual features of the user, and errors due to the working conditions is presented. (3 refs.)

70032 Errors in measuring the relative coordinates of two reflectors. G.V.Merkishin.
Meas. Tech. (USA), vol.25, no.8, p.647-9 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.24-6 (Aug. 1982). [received: April 1983]
The comparison of the interference method with the common scanning-beam method indicates that it is much simpler to realise high accuracy with the former. The results can be used for designing an effective system for measuring the distance between reflectors. (9 refs.)

70033 Artefact peaks in particle size distributions measured by the electrical sensing zone (Coulter counter) method. C.M.L.Atkinson, R.Wilson (Div. of Mech. & Optical Metrology, NPL, Teddington, England).
Powder Technol. (Switzerland), vol.34, no.2, p.275-84 (March-April 1983).
Artefact peaks on the coarse side of particle size distributions measured via the electrical sensing zone (ESZ) technique for a series of copolymer lattices have been examined. These artefacts result from particles entering the orifice mouth at the periphery. It is shown that the 'volume' shift of the artefact peak relative to the main or normal peak may be calculated from the equation $d\phi/dx \propto 1+\alpha'\{(r/R)/(1-r/R)\}^{\beta'}$ where $d\phi/dx$ is the axial component of the potential gradient across the mouth of the orifice, of radius R, at a radial distance r from the axis; α' and β' are constants with values of 0.0324 and 1.082 respectively. The relative modal heights of the artefact and main peaks are also accounted for. The occurrence of artefact peaks can introduce difficulties in the use of the 'half-count' method of calibration; a preferred alternative method involves identification of the modal value of the main peak in the measured ESZ size distribution of the reference material used for calibration. (13 refs.)

First International Conference on Optical Fibre Sensors .... See Entry 69795

Simulation method of checking RUS capacitance level gauges .... See Entry 70048

Device for measuring the motion parameters of an object with a smooth conducting surface .... See Entry 70050

The whole-field analysis of speckle interferometry for displacement and strain analysis .... See Entry 71497

Introduction to modal analysis. I .... See Entry 71504

Advances in the automation of the Czochralski process for silicon crystals .... See Entry 72985

Computing the Sun's position in the sky with an accuracy of 1° .... See Entry 73707

Ocean bottom tilt observation system .... See Entry 73948

06.30E Mass and density measurement

70034 An improved hydrostatic apparatus. S.I.Toropin.
Meas. Tech. (USA), vol.25, no.8, p.667-9 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.38-9 (Aug. 1982). [received: April 1983]
The accuracy of measurement in hydrostatic weighing is restricted by the balance, the support, the working liquid, and the methods of loading the specimen and weight onto the support. An improved hydrostatic apparatus is described which provides for thermostatting the working liquid, eliminates evaporation from the surface of the liquid, removes any vertical temperature gradient and suppresses convection currents in the liquid. The standard deviations in volume measurements is $\sigma=3.10^{-5}$ cm^3 for measurements on weights of mass from 1 to 500 g and $\sigma=8.10^{-5}$ cm^3 in measurements on weights of mass 1 kg. (2 refs.)

06.30F Time and frequency measurement

(for astronomical aspects see 95.70)

70035 Merits and limitations of submillimeter wavelength frequency standards based on an Mg(Ca) metastable beam. A.de Marchi (Istituto Elettrotecnico Nazionale 'Galileo Farraris', Torino, Italy), E.Bava, A.Godone, G.Giusfredi.
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.191-7 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Magnetic field independent transitions in Mg(Ca) metastable levels were recognized as metrologically interesting for the realization of high-performance frequency standards in the submillimeter wavelength region. The authors present an analysis of their merits, theoretical limitations, and technological difficulties. Projections are made for the performance of standards based on these transitions. (15 refs.)

70036 A new heart for Rb frequency standards?: the evacuated, wall-coated sealed cell. H.G.Robinson (Phys. Dept., Duke Univ., Durham, NC, USA), C.E.Johnson.
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.198 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
^{87}Rb hyperfine resonances observed in an evacuated, wall-coated cell, sealed since 1968, exhibit linewidths of $\sim$10 Hz for the narrow Lorentzian feature. The high-resonance Q of 0.65×10^9 shows good promise for the potential use of such cells in Rb frequency standards. (5 refs.)

70037 Characterization of frequency stability: bias due to the juxtaposition of time-interval measurements. P.Lesage (Lab. de l'Horloge Atomique, Univ. Paris-Sud, Orsay, France).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.204-7 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
The characterization of frequency stability is usually achieved by means of numerically processed time-interval measurements. The author has studied the bias occurring in the frequency stability measure when successive data with the same mean durations are added in order to get different sets of samples with various mean durations. The effect of a dead time between the data involved in the considered algorithm is pointed out. An experimental analysis is presented which checks the theoretical results for several frequency standards. (7 refs.)

70038 Automated timekeeping. II. K.Putkovich (US Naval Obs., Washington, DC, USA).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.214-17 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
For pt.I see ibid., vol.IM-21, p.401-5 (Nov. 1972). An automated system presently used by the US Naval Observatory (USNO) for determining, maintaining, and disseminating precise time and time interval (PTTI) to a worldwide community of scientific and military users is described and evaluated on the basis of present capabilities and future requirements. The objective of the system is to provide near-real-time dissemination of PTTI information from a master clock time scale with a stability in excess of a few parts in 10^{-14}. (5 refs.)

70039 A compact hydrogen maser with exceptional long-term stability [measurement standards]. D.A.Howe, F.L.Walls (Time & Frequency Div., NBS, Boulder, CO, USA).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.218-23 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
A compact passive hydrogen maser with many unique features, including a significant reduction in size over previous hydrogen masers, is described. It uses the passive mode of operation, thereby permitting use of a small microwave TE_{011} cavity which is dielectrically loaded by a low-loss alumina (Al_2O_3). The cavity is 14.6 cm outside diameter and 13.7 cm high, and weighs only 4.4 kg. the unloaded-cavity Q factor is about 6000. With a conventional source, hexapole state selector, and four magnetic shields, the volume of the entire hydrogen maser resonator package is only about 20 l. Stability data compiled from four compact hydrogen masers built at NBS is presented. Comparisons are made against the cesium standard NBS-4 and a time scale comprised of nine commercial cesium standards. (9 refs.)

70040 Performance of the four NRC long-beam primary cesium clocks Cs V, Cs VIA, Cs VIB, and CS VIC. A.G.Mungall, C.C.Costain (Div. of Phys., Nat. Res. Council, Ottawa, Ontario, Canada).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.224-7 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Performance of the four laboratory primary cesium clocks at the National Research Council (NRC) is outlined and the results of both internal and external time scale comparisons described. Difficulties which have been experienced with these clocks, including failures in both the microwave resonance excitation systems and the vacuum systems are discussed. The results of seven years of primary clock operation for Cs V and over two years for the three Cs VI clocks show that all the clocks have operated well within their estimated accuracy and stability limits of $\pm1\times10^{-13}$ for Cs V and $\pm1.5\times10^{-13}$ for Cs VIA, Cs VIB, and Cs VIC. (4 refs.)

A split second isn't fast enough .... See Entry 70028

Measurement of laser frequency stability .... See Entry 71106

06.30G Velocity, acceleration and rotation measurement

(for flow velocity measurement see 47.80)

Device for measuring the motion parameters of an object with a smooth conducting surface .... See Entry 70050

06.30L Measurement of basic electromagnetic variables

(see also 07.50 Electrical instruments and techniques)

70041 International intercomparison of electric-field strength at 100 MHz. C.F.Stubenrauch (NBS, Boulder, CO, USA), P.G.Galliano, T.M.Babij.
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.235-7 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Discusses an international intercomparison of electric field at 100 MHz. Laboratories in four countries participated in the intercomparison. Measurements from each of the laboratories fell within a range of +0.75 to −0.5 dB with respect to the overall average. The transfer standard used in the measurement is described and the details of the results are presented. (1 ref.)

Standard magnetic field radiated by two loop antennas in a coplane .... See Entry 70089

06.50 DATA HANDLING AND COMPUTATION

(see also 02.70 Computational techniques; 29.80 Nuclear information processing; for optical data processing, storage and retrieval see 42.30; for geophysical data acquisition and storage see 93.65)

70042 Computer aided determination of internal forces in bar frame structures in real time from tensometric measurements. I. E.Macha (Tech. Hochschule Opole, Opole, Poland).
Mess. & Pruef. (Germany), vol.19, no.4, p.191-2, 198 (April 1983). In German.
Considers algorithms, in conjunction with measured deformations, for the determination of forces and moments in the cross-sections of bar frameworks, with special reference to analogue-computer aided measuring systems. The computer systems comprise potentiometers, inverters, and circuitry for totalling, squaring, and extraction of square roots. The outputs of strain gauges are fed into the analogue computers. (21 refs.) *J.S.*

70043 Commodore PET computer used as a programmable gated integrator. F.DeRosa (Bell Labs., Murray Hill, NJ, USA).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.630-2 (May 1983).
A Commodore PET computer with analog-to-digital and digital-to-analog converters may be used as a programmable gated integrator with gate lengths ≥ 1 ms. Multiple gates and delays of programmed length may be obtained with suitable machine language code accessed from BASIC. (8 refs.)

Voltage contrast isolation by frame-by-frame subtraction in the scanning electron microscope .... See Entry 70158

Advances in the automation of the Czochralski process for silicon crystals .... See Entry 72985

Sensitivity analysis for premixed, laminar, steady state flames .... See Entry 73338

06.60 LABORATORY TECHNIQUES

Picosecond streak camera fluorometry. A review .... See Entry 70117

A semiconductor detector for measuring ultraweak fluorescence decays with 70 ps FWHM resolution .... See Entry 70118

Measurement conditions for continuously recording picosecond pump-and-probe spectrometers .... See Entry 70119

Picosecond spectrochronography .... See Entry 70124

High-speed optical Fourier transformer .... See Entry 71078

Synchronous amplification of subpicosecond pulses .... See Entry 71136

The self-injected nonmode-locked picosecond laser .... See Entry 71141

Femtosecond optical pulses .... See Entry 71148

Ultrashort pulse propagation in saturable media: a simple physical model .... See Entry 71149

Compression mechanism of subpicosecond pulses by malachite green dye in passively mode-locked rhodamine 6G/DODCI CW dye lasers .... See Entry 71152

Single and double mode-locked ring dye lasers—theory and experiment .... See Entry 71153

Spectral development of Picosecond pulses of mode-locked Nd-glass lasers .... See Entry 71155

Characterization of pulsed Nd:YAG active/passive mode-locked laser .... See Entry 71156

Simultaneous determination of the spectral and temporal properties of tunable, single, picosecond pulses from a short cavity dye laser .... See Entry 71163

Pulse shortening in dye laser side-pumped by TEA N_2 laser .... See Entry 71164

Subpicosecond electrical sampling .... See Entry 71226

Picosecond pulse response of broad-band guided-wave interferometric light modulators .... See Entry 71227

06.70 GENERAL INSTRUMENTATION

70044 The hobby 'scope [CRO]. C.Murphy.
Hobby Electron. (GB), vol.5, no.6, p.11-13 (June 1983).
The author discusses the design of a low cost modular oscilloscope which can be constructed by the hobbyist for under £80. For maximum flexibility, the instrument has been divided into separate functional units or modules; for under £40 there is an X-Y plotter (display unit) which will operate with either the scope add-on, to provide a full single trace oscilloscope or the curve tracer add-on, which is a useful tool for component testing and identification. A basic outline of the equipment is given while the actual constructional details will be presented in subsequent articles. (no refs.)

70045 Sensors and transducers based on optical fibres.
Regul. & Mando Autom. (Spain), vol.17, no.125, p.67-71 (Jan.-Feb. 1983). In Spanish.
Indicates that the advantages of optical fibres permit their use in infra-red pyrometry in positions not readily accessible and, since they require no electric power supplies, that they are suitable for use in inflammable media. Because transmission is affected by lack of coaxiality in the junctions of the cables, this phenomenon can be used to detect very small displacements. Optical fibres can, consequently, be used in hydrophones, in relays to detect motion and in anemometers. Besides discussing the characteristics of multimode fibres and their application in acoustic pressure sensors, the article discusses the phase modulation of monomode fibres and the uses to which this phenomenon can be put, as, for example, detecting the phase variation of a monomode fibre as a very sensitive means of measuring temperature. Since the light transmitted through optical fibres can be polarised, they can be used to meter current in high tension lines thus eliminating the problems involved in using current transformers. (no refs.) *G.W.*

70046 Faster and more precise measurements [oscilloscope developments].
Funkschau (Germany), no.8, p.65-6 (15 April 1983). In German.
A brief description of the latest 4 models from Tektronix. The two 2-channel portable oscilloscopes, types 2235 and 2236, cover a bandwidth of 100 MHz, are very bright (Ultor voltage of 14 kV) and have various facilities, for example single stroke mode for photography; the 2236 model contains a counter/timer/multimeter unit with a separate display, which is integrated with the time base and trigger system of the basic instrument. The 4-channel model 2445 is distinguished by a bandwidth of 150 MHz, 1 ns/div resolution and a trigger bandwidth of 250 MHz. Group delay differences between channels 1 and 2 can be automatically cancelled. The most complex and expensive model 2465 doubles the above performance and provides facilities for grating, locking and displaying various frequency, phase, amplitude and delay observations. (no refs.) *A.L.*

70047 A high-pressure regulator. A.N.Zisman, V.N.Kachinskii (Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1036-7 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.232-3 (July-Aug. 1982). [received: May 1983]
In investigations of phase transitions it becomes necessary to keep thermodynamic parameters constant with a high degree of accuracy. A pressure regulator which uses an auxiliary thermocompressor and a manganin pressure transducer is described. The short-time pressure stability is 0.01 bar while the long-time stability (of the order of days) reaches 0.1 bar. The regulator can be used in high-pressure apparatus with operating pressures of up to 10-20 kbar. (5 refs.)

70048 Simulation method of checking RUS capacitance level gauges. A.G.Safin, A.I.Troegubov, V.A.Fedorov, G.Z.Salganik, S.T.Taranenko.
Meas. Tech. (USA), vol.25, no.8, p.654-5 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.29-30 (Aug. 1982). [received: April 1983]
The usual method of checking the RUS capacitance level gauges consists of measuring the electrical capacitance of the sensing element SE when this is filled with a medium and comparing the output signal with the actual values of the level. A simulation method which greatly reduces the cost and time involved in the operation is described. The output parameter of the SE is not measured in the presence of a medium, but instead one measures the electrical equivalent and makes allowance for the characteristics of the medium and the properties of the particular SE. The method enables one to perform metrological evaluation of the gauges during production and under wording conditions. (2 refs.)

70049 Pulsed magnetic field calibrations for transducers for rapidly changing pressures. B.A.Vagin, V.S.Mamutov, A.I.Oreshenkov, S.M.Tarelkin.
Meas. Tech. (USA), vol.25, no.8, p.656-7 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.30-1 (Aug. 1982). [received: April 1983]
Describes a dynamic calibration method that enables one to calibrate transducers over wide frequency and pressure ranges. A pulse is provided at the transducer by means of a flat coil and a pulse-current generator PCG with a capacitance store. Calibration amounts to comparing the transducer signal with the calculated pressure. The limiting accuracy in measuring the pulse pressure is dependent on the accuracy with which the signal is recorded on the oscilloscope. The length of the calibration pressures is dependent on the period of the discharge current, which is in the range 10-200 μsec with capacitor stores. The maximum pressure amplitude for a Cu foil thickness of 0.05 mm is 2.10^6 Pa. (2 refs.)

70050 Device for measuring the motion parameters of an object with a smooth conducting surface. V.A.Zinin.
Meas. Tech. (USA), vol.25, no.8, p.661-3 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.34-5 (Aug. 1982). [received: April 1983]
A measurement transducer employing a transformer circuit with two measuring windings which form a bridge circuit with three resistors is described and the balance conditions for this circuit are presented. A device in which the measuring windings are miniature inductive probes that are independent of the exciting winding and which are placed directly on the exciting winding along the longitudinal axis of symmetry is described. The device enables one to measure accelerations in the range 0.01-10 g from the instantaneous velocity, together with the parameters of low-frequency vibration processes. (9 refs.)

70051 Silicon micromechanical devices. J.B.Angell, S.C.Terry, P.W.Barth.
Sci. Am. (USA), vol.248, no.4, p.36-47 (April 1983).
Tiny valves, nozzles, pressure sensors and other mechanical systems can be chemically etched in a wafer of single-crystal silicon. Such devices can be mass-produced much as microelectronic circuits are. (no refs.)

70052 Basis, performance and evaluation of ionization smoke-detectors. II. Chamber sensitivity and technical design. G.Meyer (Friedrich Merk-Telefonbau GmbH, Munchen, Germany).
Tech. Mess. tm (Germany), vol.50, no.4, p.155-61 (April 1983). In German.
For pt.I see ibid., no.3, p.93-7 (1983). Temperature, pressure and humidity affect the density of the chamber gas and consequently the specific ionization, the ion mobility and the recombination coefficients are also affected. The physics of ionization under these changeable conditions is discussed and equations are derived for calculating the range of α-particles, the number of ions per unit volume etc. Small ions experience acceleration in an electric field and are also affected by air streams which result in an additional velocity component, and in some losses of ions. The flight time of ions under these conditions are calculated and the mechanism of possible losses caused by air streams is graphically explained. The construction of the smoke detector as well as diagrams of amplification arrangements for voltage and current are

shown. The approximate solutions given enable optimization of the smoke chamber and quantification of the effects of some operational parameters. (22 refs.) *G.R.S.*

An improved hydrostatic apparatus .... See Entry 70034

Parameter certification for the elastic components in string transducers ....See Entry 70055

Variable-temperature glass syringe ....See Entry 70058

A monolithic conditioner for thermocouple signals ....See Entry 70062

Designer's notebook [digital multimeter design] ....See Entry 70073

Characteristics of twisted single-mode optical fiber for current sensor ....See Entry 71241

Equipment for testing shell stability at high temperature .... See Entry 71505

Equipment for studying structural metallic materials under low-cycle loading conditions with a complex stress state over a wide temperature range ....See Entry 73308

07.00 SPECIFIC INSTRUMENTATION AND TECHNIQUES OF GENERAL USE IN PHYSICS

(see also within each subdiscipline for specialized instrumentation and techniques)

07.10 MECHANICAL INSTRUMENTS AND MEASUREMENT METHODS

(for measurement in the mechanics of solids and rheology, see 46.30R; for materials testing, see 81.70)

70053 Device for producing uniaxial deformation in the surface layer of crystals. A.M.Saitsev, V.D.Kopanov, A.A.Gippius (P.N. Lebedev Inst. of Phys., Acad. of Sci., Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1029-31 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.226-7 (July-Aug. 1982). [received: May 1983]
The device described makes it possible to produce tensile or compressive deformation in the surface layer of crystals by bending the specimens. The advantages of the device include the absence of elements under a high mechanical load as well as the possibility of using specimens of comparatively simple shape and causing deformation in the ⟨100⟩, ⟨111⟩, and ⟨110⟩ directions in a single wafer, cut parallel to the (110) plane. The device can operate at low temperatures. (2 refs.)

70054 Mechanical test stand for the measurement of the vibration levels of chain saws during cutting operations. D.D.Reynolds (Joiner-Pelton-Rose Inc., Dallas, TX, USA), F.L.Wilson.
J. Sound & Vib. (GB), vol.88, no.1, p.65-84 (8 May 1983).
A mechanical test stand and corresponding test procedures for measuring the vibration levels of chain saws during cutting operations was developed for the Chain Saw Manufacturers Association. The stand includes mechanical coupling devices that approximate the dynamic response characteristics of the hand to clamp the top and rear saw handles. The stand is designed so that saws of all types and shapes can be tested. Results of hand-held and machine-held vibration tests on chain saws are discussed. The overall correlation between the vibration levels obtained from the hand-held and machine-held vibration tests on specified chain saws was good. (3 refs.)

70055 Parameter certification for the elastic components in string transducers. V.E.Mel'nikov, V.I.Obukhov, E.P.Gromov.
Meas. Tech. (USA), vol.25, no.8, p.663-5 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.35-6 (Aug. 1982). [received: April 1983]
Flat springs are widely used as elastic components in various instruments, and the accuracy of the instrument reading is largely dependent on the accuracy in making or selecting the springs. The authors consider the scope for using a string transducer to certify the parameters of flat springs. The quartz string transducer QST is made from optically pure fused quartz in welded form and is designed to measure forces in the range from 0 to 0.6 N. Experimental results obtained during three successive cycles of loading and unloading indicate that QST can be used to check flat springs with an error of measurement of about 0.5%. (2 refs.)

70056 A new kind of gyro that isn't really a gyro at all. A.J.Street, J.R.Wilkinson (British Aerospace, Brackness, England).
Natl. Electron. Rev. (GB), vol.18, p.69-72 (1983).
Gives a general view of the operation and design of a ring laser gyroscope for use in an inertial navigation system. Particular attention has been paid to error sources, to indicate where the major problems lie. By paying suitable attention to the topics discussed, and providing engineering solutions to the many practical problems involved, gyros have been produced which have a performance well within an order of magnitude of the required accuracy. (6 refs.)

Nutational motion of dynamically tuned gyroscope ....See Entry 71346

07.20 THERMAL INSTRUMENTS AND TECHNIQUES

(see also 44.50 Thermal properties of matter, 44.60 Thermodynamic processes; for radiometry and detection of thermal radiation see 07.60D and 07.62)

70057 Device for studying the thermal conductivity of melts of dielectrics in the range 1100-2000K. V.D.Golyshev, M.A.Gonik, V.A.Petrov, Yu.M.Putilin.
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1031-2 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.227-8 (July-Aug. 1982). [received: May 1983]
A design has been developed for a measuring cell in which a steady-state method of radial heat flow is implemented, making it possible to conduct experimental investigations of the thermal conductivity of melts of dielectrics at temperatures up to 2000K. (2 refs.)

70058 Variable-temperature glass syringe. S.A.Larsen, C.W.J.Scaife (Dept. of Chem., Union Coll., Schenectady, NY, USA).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.643-4 (May 1983).
Methods are described for insulating and thermostating a glass syringe that can be manipulated by hand to transfer liquids over a temperature range from −100 to +80°C. This syringe has been used to transfer liquid sulfur dioxide solutions at low temperatures and molten salts above room temperature. (4 refs.)

Study of the temperature field in a vertical cold wall reactor by holographic interferometry [CVD] ....See Entry 72997

07.20D Thermometry

70059 Thermocouple interconnection for high accuracy. N.Macdonald (Ancom Ltd., Cheltenham, England).
Electron. & Power (GB), vol.29, no.5, p.412-13 (May 1983).
Any interconnections in the construction of a thermocouple-based temperature-measuring system must be made so that no unwanted characteristics are introduced to the system. The provision of a built-in reference and the use of compensating metals can provide a solution to the problem. Permanent or removable connections can be formed in six ways which are all described and their pro's and con's discussed. (no refs.)

70060 Thermometer based on the oscillator effect. V.M.Bondar, E.A.Sidorenko, V.V.Yakovlev (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1033-4 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.229-30 (July-Aug. 1982). [received: May 1983]
Describes a temperature sensor, operating on the basis of the oscillator effect, with a frequency output of the useful signal. The sensor is fed individual or infrequently repeated pulses of duration 4-10 msec and amplitude 40-80 V. The amplitude of the useful signal is 0.5-3 V. The range of temperatures measured is −70 to +70°C. (6 refs.)

70061 Thermometric study of corrosion behaviour of high strength Al-Mg alloy in phosphoric acid in presence of halides. B.N.Oza (Chem. Dept., Sardar Vallabhai Regional Coll. of Engng. & Technol., Surat, India).
Trans. SAEST (India), vol.17, no.4, p.281-5 (Oct.-Dec. 1982). [received: May 1983]
The feasibility of the Mylius thermometric technique of studying corrosion behaviour of high-strength Al-Mg alloy in phosphoric acid has been studied. The effect of halide ions on the corrosion behaviour of the material is also examined. Thermometric curves reporting the dissolution of material in various concentrations of H_3PO_4 are obtained. The maximum temperature attained even in the higher concentration of acid is not much but time needed to reach T_{max} is more except in 25% H_3PO_4. The reaction number (RN) increases with acid concentration. Addition of various amounts of halides gives interesting results. The curves reporting the variation of RN with concentration of additives show that in lower concentration, F^- interferes with corrosion reaction whereas in higher concentration favours corrosion. Cl^- and Br^- however stifle the corrosion and afford considerable protection to the material. (14 refs.)

70062 A monolithic conditioner for thermocouple signals. A.P.Brokaw (Analog Devices Corp., Wilmington, MA, USA).
1983 IEEE International Solid-State Circuits Conference. Digest of Technical Papers, New York, USA, 23-25 Feb. 1983 (New York, USA: IEEE 1983), p.238-9, 311
The author describes an IC which by combining ice point cold junction compensation with a low level instrumentation amplifier is suitable for use with thermocouple temperature transducers. The amplifier combines the signal obtained from a thermocouple, referred to the IC temperature, with cold junction compensation voltage derived from the compensation circuit and amplifies the sum to a level nominally equivalent to 10 mV/°C of the measurement thermocouple temperature. The resulting output is as if the thermocouple has been referred to an ice bath, rather than the IC temperature, and its output signal has been raised to a more convenient level. Additional features of the circuit include single or dual power supply operation and an input overload detector which may be used as an alarm, indicating an open thermocouple. With the thermocouple input shorted, the circuit becomes a calibrated Celsius temperature sensor with a linear 10 mV/°C output. The pin strapped feedback permits the circuit to be reconfigured as a set point controller. (no refs.)

First International Conference on Optical Fibre Sensors ....See Entry 69795

Designer's notebook [digital multimeter design] ....See Entry 70073

Birefringent filter temperature sensor ....See Entry 71221

Fiber optics sensing techniques ....See Entry 71242

Differential absorption distributed thermometer ....See Entry 71243

Optical fiber thermometer for medical use ....See Entry 73655

07.20F Calorimetry

Preliminary research in the measurement of the solar radiation by transient technique ....See Entry 73413

07.20K High-temperature techniques and instrumentation; pyrometry

70063 High temperature production by microwaves. J.C.Badot (ENSCP, Paris, France).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.2, p.65-76 (1982).
Microwaves can be used for the production of high temperatures. By this method, it is possible to heat many refractory oxides (SiO_2, Al_2O_3, ZrO_2, rare earth oxides, etc.) up to their melting temperature. Various applications of the microwave technique may be considered, including crystal growth in self-crucible, and solid state reactions under high electric fields. (9 refs.)

Interpretation of laser pulse heating experiments for determination of vapour pressures of nuclear fuel materials at high temperatures ....See Entry 72092

07.20M Cryogenics

70064 The cycle of a helium refrigerator with a steam-liquid turboexpander. V.I.Ardashev, D.I.Plachendovskii.
Izv. VUZ Mashinostr. (USSR), no.3, p.91-5 (1983). In Russian.
Results are presented of a computer-aided variational analysis to determine optimum parameters of two types of compressor in a cryogenic installation,

using a turboexpander in a saturated steam region and turboexpanders at intermediate cooling stages. The mathematical model supplied relates the efficiency of the turbomachines with the operating parameters under different conditions. The structure of the computer programme is presented. The lower limit of the refrigeration capacity of the installation, at optimum parameters of the cycle, is established. (11 refs.) *Z.F.V.*

70065 L'Air Liquide helium refrigerators and liquefactors. G.Gistau (Refrigeration Dept., L'Air Liquide, Paris, France).
Indian J. Cryog., vol.7, no.4, p.162-7 (1982).
Today, helium refrigeration is to be used in different fields: superconducting coils to get very high magnetic fields for particle analysis, particle accelerators, cryoelectricity (AC generation), power generation (fusion); Power transmission lines; cooling of neutron beams in research nuclear reactors. How does L'Air Liquide meet the requirements of the above applications? Main features concerning technology used by L'Air Liquide to build helium refrigerators or liquefiers (compressors, heat exchangers, cryogenic expanders, control systems, cryogenic storages and transfer lines). Some standard or special equipment are described with slide projection. (1 ref.)

70066 Preliminary design of reverse Stirling cycle refrigerator. A.B.Fakolawala, P.R.Tailor (Dept. of Mech. Engng., SVR Coll. of Engng. & Tech., Surat, India).
Indian J. Cryog., vol.7, no.4, p.172-6 (1982).
This paper deals with the development of consolidated chart by optimizing the parameters involved in the Schmidt analysis. The chart thus developed is used for preliminary design states of reverse Stirling cycle refrigerator—with illustrated example. (3 refs.)

70067 Development of rotating liquid helium dewar with transfer coupling. K.A.Durga Prasad, S.Ameerjan (Corporate R&D Div., Bharat Heavy Electricals Ltd., Bhopal, India), R.Srinivasan.
Indian J. Cryog., vol.7, no.4, p.184-7 (1982).
Of the many possible large scale applications of superconductivity, applications to superconducting (SC) generators for central power stations are very promising. Such generators will have a rotating SC field winding maintained at about 4K and a normal stationary armature at ambient temperature. Any development work in this application requires solutions to many mechanical and cryogenic problems and hence the work should proceed in stages. As a first step the authors have taken up a programme to develop a rotating helium dewar with transfer coupling. This paper describes the design and fabrication of the system, experimental set up and the performance tests carried out on the system. This work was carried out in collaboration with IIT Madras. (no refs.)

70068 Cryostat for mechanical testing of materials at 4.2K. M.C.Valsakumar, N.Kannan, T.S.Radhakrishnan (Materials Sci. Lab., Reactor Res. Centre, Kalpakkam, India).
Indian J. Cryog., vol.7, no.4, p.188-93 (1982).
A liquid helium cryostat has been fabricated to be coupled to an Instron Model 1195 Universal Testing Machine for mechanical testing of materials at low temperatures. The sample is held between two grip assemblies, the top one being connected to the load cell by a long pull-rod. The bottom grip is connected to a tube, co-axial to the pull-rod, which in turn is attached to the moving cross-head. Studies with this set-up give information about the yield characteristics at room temperature, 77K and at 4.2K. With a manostat, the temperature ranges can be extended to 64-80K and to 1-5K. The effect of magnetic field on yield characteristics especially due to the viscous drag of dislocations by electron cloud can be studied by a 10 kG super-conducting magnet around the sample. (17 refs.)

70069 Solid state helium vapour pressure thermometer. M.J.Mehta, B.K.Basu (Tata Inst. of Fundamental Res., Bombay, India).
Indian J. Cryog., vol.7, no.4, p.200-2 (1982).
This paper describes a solid state helium (He^4) vapour pressure thermometer. The thermometer consists of a pressure transducer, A to D converter, memory and LED display. The standard He^4 vapour pressure temperature scale T_{58} is used. Pressure to temperature conversion is done by the use of solid state memory (lookup table). Main feature of this thermometer is that over full range (i.e. 4.2K to 1K) the accuracy of pressure measurement is better than 1% and resolution of pressure measurement is 1.6 mm Hg from 760 mm to 25 mm Hg and 0.1 mm Hg below 25 mm Hg. Temperature is directly displayed in Kelvin. (2 refs.)

Josephson volt standard at the National Physical Laboratory, New Delhi ....See Entry 70026

Cross polarization magic-angle spinning NMR at cryogenic temperatures ....See Entry 70092

Small cryostat for cooling a photomultiplier ....See Entry 70101

Rapid temperature variation of hopping conduction in GaAs low-temperature bolometers ....See Entry 70112

Low temperature heat transfer studies on exfoliated vermiculite ....See Entry 72174

07.30 VACUUM PRODUCTION AND TECHNIQUES

(inc. pressures below 1 atmosphere; see also 47.45 Rarefied gas dynamics; 81.15G Vacuum deposition)

Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society ....See Entry 69783

Formulas, facts and constants. For students and professionals in engineering, chemistry and physics ....See Entry 69803

Application of physical effects for the detection of small ion currents in vacuum ....See Entry 70150

Simple mechanism for in situ adjustment of gratings in UHV monochromators ....See Entry 71222

07.30C Vacuum pumps

70070 Intermediate pressure in two-stage liquid-annular vacuum pumps. I.V.Avtonomova.
Izv. VUZ Mashinostr. (USSR), no.3, p.87-90 (1983). In Russian.
On the basis of results of experimental investigations of Soviet-made liquid-annular vacuum pumps, a procedure is developed for the analysis of their operation, and a dependence is derived for the intermediate pressure of two-stage liquid-annular vacuum pumps. Recommendations are presented for the choice of the peripheral velocities of the working wheels of the first and second stages. (2 refs.) *Z.F.V.*

07.30D Vacuum meters

A small universal quadrupole mass spectrometer ....See Entry 70143

07.35 HIGH PRESSURE PRODUCTION AND TECHNIQUES

(inc. pressures above 1 atmosphere)

70071 Leak detection of high pressure vessels. S.Bohatka, I.Berecz, G.Horkay, G.Langer (Inst. of Nuclear Res., Hungarian Acad. of Sci., Debrecen, Hungary).
Vacuum (GB), vol.33, no.1-2, p.17-18 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
The most sensitive leak detection method for high pressure vessels is based on the use of a mass spectrometer leak detector. The authors Q6OU type universal quadrupole mass spectrometer was incorporated into the leak test system (type LD-60) designed for the testing of the axial compensators of steam pipings. During manufacture of these items it is possible to detect leak rates ranging from 10^{-9} mbar l s^{-1} and 10^{-7} mbar l s^{-1} with a response time and 5 min of 5 s, respectively, using a combined slow-fast sampling unit and He as the test gas. The leak detector is pumped by an air-cooled, automatically controlled diffusion pump system. (no refs.)

A high-pressure regulator ....See Entry 70047

07.50 ELECTRICAL INSTRUMENTS AND TECHNIQUES

70072 A miniature ionisation probe technique using a multilayer circuit board for the study of explosive phenomena in primary and secondary explosives. R.J.Spear, J.R.Bentley, M.G.Wolfson (Materials Res. Labs., Victoria, Australia).
Combust. & Flame (USA), vol.50, no.3, p.249-58 (April 1983).
A miniature ionisation probe technique using a multilayer circuit board has been developed. Full experimental details including construction of the boards, explosive charge preparation, and instrumentation are reported. Each copper layer in the circuit board functions as an ionisation probe and optimum conditions were achieved with a probe density of 15/cm, i.e. probe separation about 0.75 mm. Explosive samples were studied in a geometry similar to that of practical fuse detonators. Accurate, reproducible detonation velocity measurements have been obtained for the primary explosives service lead azide, at a wide range of densities, lead azide RD1343, silver azide and mercuric 5-nitrotetrazole, and the secondary explosive tetryl. (8 refs.)

70073 Designer's notebook [digital multimeter design]. T.Orr.
Electron. Today Int. (GB), vol.11, no.10, p.18-20 (Oct. 1982). [received: May 1983]
The author shows how to use DVM chips go get all the basic ranges of a multimeter. Sufficient information is described to allow the design of a digital multimeter, customised to give exactly the ranges and features most desired. Also discussed are techniques for measuring temperature and dealing with very small signals. (no refs.)

70074 Correct measurement of AC voltages: RMS measurement. P.Tobschall.
Funkschau (Germany), no.8, p.61-4 (15 April 1983). In German.
A general survey of the state of the art, describing and comparing the scope, performance and price of thermal, analog and digital instruments. The treated basic waveforms are sine wave, half-wave rectifier output, sawtooth and square wave. Modern thermoelectric meters make full use of thin film and IC techniques, with operational amplifiers providing automatic balance facilities. Digital meters contain microprocessors and A/D converters, and their speed and resolution decide the accuracy and frequency range of the instrument. Illustrations comprise block diagrams and tables. (no refs.) *A.L.*

70075 The NPL moving-coil ampere determination. B.P.Kibble, R.C.Smith, I.A.Robinson (NPL, Teddington, England).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.141-3 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
The NPL apparatus to realize the SL ampere has a ±1 parts per million (p.p.m.) reproducibility. It employs two rectangular coils of square cross section glued together and connected in series in opposing senses. An uncertainty cannot be given as there is as yet insufficient investigation of systematic errors, but in due course it is expected that 0.1-p.p.m. accuracy can be achieved. (7 refs.)

70076 Realizing the ampere by levitating a superconducting mass—a suggested procedure. B.P.Kibble (NPL, Teddington, England).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.144 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
By observing the current in a superconducting coil required to levitate a superconducting body and, separately, the voltage induced when the body is moved with the current still flowing, the electrical and mechanical units of power can be related to realize the ampere in a way which avoids errors arising from unaccounted dissipative work. (6 refs.)

70077 The maintenance and comparison of standards of electromotive force at the BIPM. T.J.Witt, D.Reymann (Bur. Internat. des Poids et Mesures, Pavillon de Breteuil, Sevres, France).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.260-7 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Describes improved standard cell comparison equipment, temperature-controlled enclosures, and measurement techniques used to relate reference groups of high-quality standard cells to the BIPM (Bureau International des Poids et Mesures) Josephson-effect standard with an uncertainty of less than 10 nV. This performance is demonstrated by results obtained over four years. The same techniques are now being applied in the routine comparison of international standards of electromotive force by the transfer of standard cells. An analysis of the behavior of the cells that have participated in comparisons lasting 12 years indicates that the uncertainty due to the instability of cells as transfer standards is about 0.5 μV, i.e. one hundred times greater than the best reproducibility in the laboratory. A comprehensive tabulation of uncertainties shows this to be by far the greatest single contribution. (13 refs.)

70078 High-accuracy Josephson potentiometer [voltage standard]. T.Endo (Electrotech. Lab., Ibaraki, Japan), M.Koyanagi, A.Nakamura.
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.267-71 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
A potentiometer with the extremely small relative uncertainty of a few parts in 10^9 has been developed by utilizing the property that a Josephson junction generates a precise voltage that is variable with frequency and step number. The evaluated total uncertainty is 2.5×10^{-9} V for measurements at the 1-V level. This small uncertainty is attributed to the generation of a higher than normal Josephson voltage, that is, on the order of 100 mV. (8 refs.)

70079 The reproduction of the As-maintained unit of voltage at IEN by means of 2*e*/*h*. D.Andreone, E.Arri, V.Lacquaniti, G.Marullo (Istituto Elettrotecnico Nazionale Galileo Ferraris, Torino, Italy).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.272-5 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
The IEN (Istituto Elettrotecnico Nazionale) participates in the joint venture of the national standardizing laboratories which reproduce the as-maintained unit of voltage by means of the fundamental constant $2e/h$. The adopted long-life thermally cyclable Josephson junctions with Nb-base electrodes are described, and the apparatus, procedures, and measurements used to monitor the unit of voltage at IEN are outlined. The results indicate a small positive drift of about 6×10^{-8} per year for V_{IEN-69}; on January 1, 1980 they gave the relation $2e/h=(483\ 594.41\pm0.1)$ GHz/V_{IEN-69}. (12 refs.)

70080 Point-contact Josephson voltage standard. M.Ibuka, S.Naito, T.Furuya (Yokogawa Electric Works Ltd., Tokyo, Japan).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.276-9 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Describes a practical Josephson voltage standard used to calibrate transfer standard cells. The standard comprises a niobium point-contact Josephson junction—used as the voltage reference—and a series-parallel combination voltage divider. This Josephson junction is robust and withstands temperature cycling between room temperature and 4.2K. The point contact is adjusted at room temperature. The output of the point-contact Josephson junction at 4.2K with a 9.59-GHz microwave signal applied is about 1.9 mV. The divider ratio is 1/529, and divider ratio stability is better than 0.2 ppm/year at room temperature. The point-contact Josephson junction described was compared with the tunnel junction used to determine the Japanese standard volt. The difference between the two was less than 0.5 ppm. (6 refs.)

70081 A device for measuring the electrical potential in an insulator. Yu.P.Gorbachev, K.A.Dergobuzov, V.I.Dovgii, O.B.Evdokimov, A.V.Samoilik, Yu.A.Solov'ev, N.I.Yagushkin (Tomsk Polytech. Inst., Tomsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1015-17 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.213-15 (July-Aug. 1982). [received: May 1983]
A device is described for remote measurement of the electrical potential in a specimen exposed to a particle beam. The sign and magnitude of the potential are determined from the change in the number of β particles transmitted by the specimen. Remote potential measurements have been made on three insulating specimens in turn. (2 refs.)

70082 A simple technique for the estimation of the bulk resistivity of powdered materials. J.R.Whyte,Jr. (Res. & Dev. Center, Freeport Minerals Co., Belle Chasse, LA, USA), K.Seshan.
J. Electrochem. Soc. (USA), vol.130, no.4, p.971-4 (April 1983).
A simple technique to accurately measure the bulk resistivity of powdered substances has been developed. It uses a van der Pauw resistivity cell based on four probes arranged on a circle concentric with the edges of a circular compact. The technique provides some structural information as well as electrical properties information about the powder under test. (10 refs.)

70083 Measuring method for electric field ionisation from trapping levels. Y.Hoshino (Yokosuka Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Kanagawa-ken, Japan), K.Arishima.
J. Phys. E (GB), vol.16, no.5, p.427-30 (May 1983).
A technique for measuring electric field ionisation from trapping levels is proposed. The electric field is increased at a constant rate and the current stimulated by the electric field is measured by a personal computer-controlled measuring system. The stimulated current is analysed theoretically under the premise that release from trapping levels is controlled by a mechanism which Poole-Frenkel theory attempts to explain. The experimental technique and analysis are applied to a Cu-phthalocyanine binder photoconductor. (8 refs.)

70084 A field-strength measuring probe for the assessment of personal danger in the neighbourhood of high-power radio transmitters. D.Hoff (Westdeutscher Rundfunk, Koln, Germany), K.-H.Turkner.
NTG-Fachber. (Germany), vol.83, p.97-108 (1983). (Horrundfunk 6 (Sound Broadcasting), Mannheim, Germany, 23-25 Nov. 1982).
The probe has a frequency range of 150 kHz to 30 MHz, and is constructed of a cubical metal casting carrying on its sides three dipoles, perpendicular to each other, for the measurement of electric field-strength, and three loop antennae, perpendicular to each other, for magnetic field-strength measurements. The overall diameter of the probe is 30 cm. The antennae are connected through amplifier stages to a thermo-converter activating the indicating equipment. (8 refs.) *A.G.P.*

70085 Dielectric permittivity measurements in the ultralow frequency region. S.Takeishi, R.Nozaki, S.Yagihara, S.Mashimo (Dept. of Phys., Faculty of Sci., Tokai Univ., Kanagawa, Japan).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.639-40 (May 1983).
A new DC transient method is described for fast measurements of dielectric permittivity in the μHz frequency region. A square-wave voltage pulse is applied to the dielectric instead of the usual step voltage pulse. The whole transient current is measured two times faster than in the conventional method using the step voltage. (3 refs.)

70086 High-resolution probing of surface-charge distributions on corona- and friction-charged teflon FEP foils. R.Gerhard-Multhaupt (Inst. for Electroacoustics, Tech. Univ. Darmstadt, Darmstadt, Germany).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.111-16
An apparatus for measuring surface-charge distributions on high-polymer electret foils has been constructed. The device can measure surface potentials of up to 1.4 kV with a lateral resolution of about 100 μm. It is employed to investigate the surface-charge variations caused by the control grid in corona-charging experiments. In addition, surface-charge patterns on Teflon FEP electrets charged by means of a triboelectric charging apparatus are reported. (8 refs.)

70087 A new conductivity gauge for antistatic films. A.R.Blythe (Petrochem. & Plastics Div., ICI, Welwyn Garden City, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.117-22
In making antistatic films it is important to be able to monitor the surface conductivity during the production process. Typical products have, however, a relatively low surface conductivity, in the range 1 to 1000 pS, making measurements rather difficult. This paper describes a novel method to gauge the level of surface conductivity continuously on a moving, antistatic web, using an entirely non-contacting probe. The system relies on observing an induced charge distribution by means of an electric field meter. A version which scans a web laterally has been developed and has been used successfully at film line-speed above 1 m/s. (4 refs.)

Josephson volt standard at the National Physical Laboratory, New Delhi .... See Entry 70026

International intercomparison of electric-field strength at 100 MHz .... See Entry 70041

Simulation method of checking RUS capacitance level gauges .... See Entry 70048

Subpicosecond electrical sampling .... See Entry 71226

Characteristics of twisted single-mode optical fiber for current sensor .... See Entry 71241

Sensitivity vs. size of fibre-optic interferometric sensors .... See Entry 71244

Corona charging of immobilized spherical particles .... See Entry 71835

Electrical properties of Te diffused silicon .... See Entry 72164

Voltage dependence of the d_{31} tensor element in Pb(Ti,Zr)O_3 . See Entry 72737

07.55 MAGNETIC INSTRUMENTS AND TECHNIQUES

70088 The Josephson effect measures very weak magnetic fields. T.D.Clark, R.J.Prance (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
Elektrotechnik (Germany), vol.65, no.7, p.24-7 (7 April 1983). In German.
The basic physics of the Josephson element, as used in the 'weakly-coupled SQUID ring' magnetometer, is outlined. Possibilities for the further development of the technique for measuring extremely weak magnetic fluxes, are discussed. (4 refs.) *F.Q.*

70089 Standard magnetic field radiated by two loop antennas in a coplane. H.Nakane (Dept. of Electrical Engng., Sci. Univ. of Tokyo, Tokyo, Japan), S.Obuki, S.Omori, I.Yokoshima.
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.238-40 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
A RF magnetic field generator consisting of two radiating loop antennas placed in a coplane is proposed, which has relatively uniform field distribution and permits easy alignment of the antennas. A standard field generator based on this idea, having flat frequency characteristics up to 30 MHz, has been designed and tested. It was confirmed that misalignment of the receiving antenna up to 2 cm, for a distance of 30 cm between the radiating loop and the test point, causes an error of only ±0.1 dB. In terms of frequency characteristics, the field strength at the test point was flat within ±0.15 dB from 1 to 30 MHz. (6 refs.)

70090 Attachment to the Shl-1 magnetic-induction meter for displaying the result in magnetic-induction units. V.I.Barchuk (Semiconductor Inst., Acad. of Sci., Kiev, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.996-7 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.195-6 (July-Aug. 1982). [received: May 1983]
An attachment to the Shl-1 magnetic-induction meter is described for use with a Ch3-34A electronic counting frequency meter to display the results in units of magnetic induction. The error of 2×10^{-7} introduced by the attachment is much less than the error of measurement of the Shl-1. (3 refs.)

Pulsed magnetic field calibrations for transducers for rapidly changing pressures .... See Entry 70049

A field-strength measuring probe for the assessment of personal danger in the neighbourhood of high-power radio transmitters .... See Entry 70084

Sensitivity vs. size of fibre-optic interferometric sensors .... See Entry 71244

Detection techniques for measurement of DC magnetic fields using optical fibre sensors .... See Entry 71247

Measurement of magnetic bubble domain wall energy density .... See Entry 72648

Magnetic bias field generator design for the measurement of magnetic garnet film properties using Faraday rotation .... See Entry 72775

07.58 MAGNETIC RESONANCE SPECTROMETERS, AUXILIARY INSTRUMENTS AND TECHNIQUES

(see also 61.16N EPR and NMR determinations)

70091 Field stabilizer for permanent magnet of nuclear magnetic resonance spectrometer. G.V.Ivanov, D.I.Vainshtein, V.A.Safin, V.D.Shchepkin.
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.967-8 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.168-9 (July-Aug. 1982). [received: May 1983]
Describes a current stabilizer for creating the supplementary field (0.035 T) to the permanent magnet and compensating its temperature-induced drift. The stability of the resulting field is 1.2×10^{-5}/h or greater. (4 refs.)

70092 Cross polarization magic-angle spinning NMR at cryogenic temperatures. V.Macho, R.Kendrick, C.S.Yannoni (IBM Res. Lab., San Jose, CA, USA).
J. Magn. Resonance (USA), vol.52, no.3, p.450-6 (May 1983).
A magic angle spinning (MAS) apparatus which can be used for high resolution solid state NMR at temperatures as low as 15K is described. To demonstrate the utility of this apparatus, ^{13}C spectra of molecules containing methyl groups have been investigated at cryogenic temperatures. The spectra, which are described in detail, provide direct evidence for the slowdown of methyl rotation. (15 refs.)

70093 A high sensitivity toroid detector for ^{17}O NMR. T.E.Glass, H.C.Dorn (Dept. of Chem., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
J. Magn. Resonance (USA), vol.52, no.3, p.518-22 (May 1983).
The low natural abundance (0.037%) and modest nuclear moment for the ^{17}O nuclide have until recently severely restricted ^{17}O NMR studies. In addition, the quadrupole ($I={}^5/_2$) dominated relaxation mechanism and corresponding short T_1 and T_2 relaxation times typically yield ^{17}O NMR spectra with linewidths of 10 Hz-1 kHz. The authors study the S/N advantage of the toroid configuration for ^{17}O NMR studies in comparison with the commonly employed Helmholtz coil design. (8 refs.)

70094 Possibility of carrying out field-free paramagnetic resonance by the two-frequency method. N.I.Deryugina, A.B.Roitsin (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1783-4 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3147-9 (Oct. 1982). [received: April 1983]
By virtue of the specific characteristics of multiquantum transitions (narrow lines, additional selection rules, etc.) the information provided by the investigations and the potentialities of practical applications are increased substantially. The authors consider the possibility of using two-photon transitions to effect paramagnetic resonance in a zero magnetic field (field-free resonance). (17 refs.)

Formulas, facts and constants. For students and professionals in engineering, chemistry and physics .... See Entry 69803

Multipulse techniques to edit ^{13} NMR spectra of deuterated compounds. Useful methods to follow deuterium in biosynthesis .... See Entry 70913

EPR spectroscopy of single crystals using a two-circle goniometer .... See Entry 72661

07.60 OPTICAL INSTRUMENTS AND TECHNIQUES

(for radiation detection, see 07.62; for spectroscopy and spectrometers, see 07.65; for holography, see 42.40; for optical sources and standards, see 42.72; for optical lens and mirror systems, see 42.78; for optical devices, techniques and applications, see 42.80; for optical testing and workshop techniques, see 42.85; for radiation spectrometers and spectroscopic techniques, see 29.30; for radiation measurement, detection and counting, see 29.70)

70095 The evolving problems in precise optical measurements. L.M.Biberman (Inst. for Defense Analyses, Alexandria, VA, USA).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.217-52 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Discusses problems associated with the development of high accuracy standards coupled with the basic practicality of producing the tools for the working scientist or engineer. (8 refs.)

70096 Optical-transmittance measurement method in the FOCA2 experiment. F.Falciglia (Istituto di Fisica, Univ. di Catania, Catania, Italy), A.Garuccio, G.Iaci, L.Pappalardo.
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.66-70 (14 May 1983).
A method for measuring optical transmittance of calcites in condition similar to those of experiments involving single-photon techniques is described. The use of a pulsed-light source together with a coincidence technique yields high signal-to-noise ratio, so allowing a more accurate valuing of the parameters of interest. (5 refs.)

70097 Theory of azimuthal compensator for white light. F.Ratajczyk (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.395-401 (1982).
A possibility of employing an azimuthal compensator to measurements of small local wavefront deformation as well as optical path difference occurring due to birefringence in white light have been presented. There, it was stated previously by the author (see ibid., vol.11, p.483, 1981) that this method had been verified experimentally but neither its validity was proved mathematically nor its range of applicability established. Both these problems are the subject of this work. (2 refs.)

07.60D Photometry and radiometry

(inc. colorimetry; see also 07.62 Detection of radiation)

70098 Notes on the method of fluorescence and phosphorescence measurements—by the use of Hitachi MPF 4 fluorescence spectrophotometer. T.Moriya (Electrotech. Lab., Ibaraki, Japan).
Bull. Electrotech. Lab. (Japan), vol.47, no.2, p.81-8 (1983).
Points out that in the standard fluorescence and phosphorescence spectrophotometer the measurement geometry as well as the components of the system must be carefully chosen in accordance with characters of the fluorescing samples. The right angle arrangement for fluorescence measurements are examined theoretically and the experimental data on the calibration curve of the detected fluorescence intensity versus the absorbed excitation light shown. The theory explains very well the experimental results. (11 refs.)

70099 Light measurement many ways. J.Kelley, C.P.Comeau (Internat. Light Inc., Newburyport, MA, USA).
Photonics Spectra (USA), vol.17, no.3, p.52-6 (March 1983).
Provides a general description of some of the major application areas and of corresponding instrumentation characteristics, followed by consideration of three of the newer areas—solar power and energy measurement, photochemical etching and ultraviolet curing—that increasingly require such instrumentation. The measurement instrumentation considered includes:- radiometers and photometers; laser power and energy meters; fiber optic radiometers; and spectroradiometers. (no refs.)

70100 Calculation of the luminous flux of a point source of light to a rectangular surface. J.Habel.
Elektrotech. Obz. (Czechoslovakia), vol.72, no.4, p.188-95 (April 1983). In Czech.
The article contains deduced relations for the calculation of the luminous flux from a rotationally symmetric radiating point source to a rectangle which lies either on the plane perpendicular to a chosen direction of relative luminous intensity or in a plane parallel to a chosen direction of luminous intensity. The curve given by the plane section of the photometric surface of luminous intensity is described by the characteristic function of this intensity in the form $f_1(\alpha)=\cos^n \alpha$, where $n=0, 1, 2, ..., 5$. Examples of designed graphical aids are presented to help the solution of deduced relations. The considerations are supplemented by an example showing how to proceed by practical calculations. (5 refs.)

70101 Small cryostat for cooling a photomultiplier. A.A.Samokhvalov, Yu.P.Sukhorukov, A.F.Gunichev (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1039-40 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.234 (July-Aug. 1982). [received: May 1983]
A simple cryostat is described for cooling end-window photomultipliers with liquid-nitrogen vapor, making it possible to regulate the temperature of the photomultiplier photocathode from room temperature to −100°C. The use of the cryostat increases the S/N ratio of the photomultiplier by a factor of 20 in the photon-V counting technique. (2 refs.)

70102 Problems on luminance measurement and calibration of luminance meter. Y.Mishima (Illuminating Engng. Inst. of Japan, Tokyo, Japan).
J. Illum. Eng. Inst. Jpn. (Japan), vol.67, no.1, p.15-17 (Jan. 1983). In Japanese.
In brightness measurement, care should be taken to set up a brightness meter for conditions under which: (1) rays of light incident upon the light-receiving surface of the meter will be direct from the subject surface without reflection, and (2) the relative spectral-sensitivity of the meter will be closest to the standard relative-visibility. A light-diffusion plate capable of providing a uniform brightness and a light distribution in cosine law should be used in brightness-meter calibration. These are discussed. (8 refs.) *K.B.*

70103 More about the interference colours. F.Ratajczyk (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.379-93 (1982).
In the physics textbook or professional literature many controversial opinions may be found as to the possibility of measuring optical path differences with the aid of interference or pseudointerference polariscope colours. These controversies are mainly due to the acceptance of some incorrect assumptions. The author looks at the possibility of applying the interference and polariscope colours to the real conditions of measurement as a measure of optical path difference. (3 refs.)

High resolution submillimeter-wave radiometry of supersonic flow .... See Entry 71593

07.60F Polarimetry and ellipsometry

70104 Measuring small AC Faraday rotation: a novel method. R.M.Duffy, R.P.Netterfield (CSIRO Div. of Appl. Phys., Lindfield, Australia).
Appl. Opt. (USA), vol.22, no.9, p.1272-3 (1 May 1983).
An essential requirement in ellipsometry and polarimetry is accurate setting of crossed polarizers. Visual or electronic detection of the null is not very accurate. Increased sensitivity is obtained by angular modulation of the plane of polarization between the polarizers and detection of the light flux at the frequency of modulation using a lock-in amplifier. At the true null setting, the amplitude of the detected signal is zero and the phase changes sign. It has been shown that the amplitude of the angular modulation angle has an optimum value depending on the fraction of depolarized light passing through the system and the importance assigned to angular resolution, wavelength resolution, and speed of response. For these reasons and also to obtain consistent sensitivity of setting, the modulation amplitude should be known. A method of measurement is suggested which uses electronic detecting equipment which is commonly available with nulling type ellipsometers. (2 refs.)

70105 Modulation error in determining polarization azimuth. S.A.Alekseev, V.T.Prokopenko.
Meas. Tech. (USA), vol.25, no.8, p.645-7 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.23-4 (Aug. 1982). [received: April 1983]
Modulation null ellipsometry employs the Faraday effect and has a sensitivity in polarization azimuth measurement of 0.0002°. One of the features of systems employing this principle is the modulation error. The authors have found that there are phase shifts in the optical components between the modulator and analyzer which result in a modulation component of the systematic error, whose value is comparable with or even larger than the change in state of polarization in these elements. An analysis of this error and its experimental verification are described. (4 refs.)

More about the interference colours .... See Entry 70103

Use of an ADP four-crystal electrooptic modulator in ellipsometry .... See Entry 71224

07.60H Refractometry and reflectometry

70106 Methods of measuring the profile of the refractive index of optical fibres. J.Holoubek.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.3, p.65-8 (March 1983). In Czech.
For previous part see ibid., no.2, p.47 (1983). The following methods which can be used for measuring multi-mode fibres are described: transmission (near-field) methods; scattering methods; a focusing method; and a fluorescent method. Methods which are suitable for determining the refractive index of single-mode fibres are surveyed. (46 refs.) *E.D.*

70107 Changes of refractive index in glass induced by UV-irradiation and a new possibility of their determination. S.Gebala, I.Wilk (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.483-8 (1982).
Indicates the possibility of measuring the small changes in refractive index provided that they are of a periodic nature. (4 refs.)

70108 Differential reflectometry and its application to the study of alloys, ordering, corrosion, and surface properties. R.E.Hummel (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA).
Phys. Status Solidi a (Germany), vol.76, no.1, p.11-44 (16 March 1983).
Differential reflectrometry is a surface analytical technique. It uses ultraviolet, visible, and infrared light as a probing medium. The interaction of light with 'strong absorbing materials', such as metals, occurs in the first hundred to two hundred Angstrom units. Thus, the differential reflectometer probes fifty to one hundred atomic layers into non-transparent solid surfaces. The author describes the differential reflectometer and its applications to problems in materials science and solid state physics. It also reviews pertinent results obtained with this instrument. (88 refs.)

First International Conference on Optical Fibre Sensors .... See Entry 69795

Progress in fiber test standards .... See Entry 71236

OTDR puts fibers to the test .... See Entry 71237

07.60L Interferometry

70109 Standing wave sensor. E.W.Silvertooth, S.F.Jacobs.
Appl. Opt. (USA), vol.22, no.9, p.1274-5 (1 May 1983).
Describes the performance of a one-beam interferometer or standing wave sensor, which is a photoelectric analog of Wiener's photographic sensor of the standing waves produced when light reflects from a mirror. As Wiener showed, when a collimated monochromatic light beam reflects off a plane mirror there are planes of nodes (and antinodes) spatially positioned at half-wavelength intervals when the beam is normal to the mirror. A photocathode can sense their relative spacing as either the mirror or photocathode is translated perpendicular to these planes. The sensitivity of this device depends on the thickness of the effective photosensing surface, and the authors have found this to be very small compared to the wavelength of light. The photoelectric sensor consists of a photomultiplier tube comprised of two optically flat end windows, with a 500-Å thick semitransparent photocathode deposited on the inner surface of one window. The tube also contains a six-stage annular dynode assembly such that a collimated laser beam can pass through the tube and be returned by mirror, thus setting a standing wave. (2 refs.)

70110 Phenomenon of the double-feedback F-P optical oscillation. Li Yung-gui, Zhang Hong-jun (Inst. of Phys., Acad. Sinica, Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.309-14 (March 1983). In Chinese.
English translation in: *Chin. J. Phys. (USA)*
The F-P passive optical oscillator with two feedback circuits is described. This oscillator transforms an input with continuous intensity of light into multivibrating optical pulses or optical sinusoidal signal output. The principle of oscillation is analysed. The experimental results in agreement with the analysis are presented. (8 refs.)

70111 Device for observing microheterogeneities in interference coatings. E.I.Firsov, P.G.Shlyakhtenko (Leningrad Inst. of Textile & Light Industry, Leningrad, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1028-9 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.225 (July-Aug. 1982). [received: May 1983]
With a view to increasing the contrast in investigations of heterogeneities in interference coatings in the Linnik interferometer, the authors propose that a monochromator, tunable to the wavelength at which reflection of light from the coating is minimum, to be used as the illuminator. (8 refs.)

First International Conference on Optical Fibre Sensors ....See Entry 69795

Laser interferometer gravitational radiation detectors ....See Entry 69971

Errors in measuring the relative coordinates of two reflectors ....See Entry 70032

Separation of the absolute retardation fringes by using polarizing holography ....See Entry 71087

Picosecond pulse response of broad-band guided-wave interferometric light modulators ....See Entry 71227

Fiber optics sensing techniques ....See Entry 71242

Sensitivity vs. size of fibre-optic interferometric sensors .... See Entry 71244

Interferometric sensor using phase conjugate mirrors .... See Entry 71246

Detection techniques for measurement of DC magnetic fields using optical fibre sensors ....See Entry 71247

A single-mode fibre Michelson interferometer sensor .... See Entry 71248

Signal recovery techniques for unbalanced fibre interferometric sensors illuminated by laser diodes ....See Entry 71249

Fiber optic interferometric sensor development at NRL ....See Entry 71250

The whole-field analysis of speckle interferometry for displacement and strain analysis .... See Entry 71497

Measurement of liquid film profiles by moire topography .... See Entry 72187

Study of the temperature field in a vertical cold wall reactor by holographic interferometry [CVD] ....See Entry 72997

07.62 DETECTION OF RADIATION (BOLOMETERS, PHOTOELECTRIC CELLS, I.R. AND SUBMILLIMETRE WAVES DETECTION)

70112 Rapid temperature variation of hopping conduction in GaAs low-temperature bolometers. J.K.Wigmore, B.Tlhabologang (Dept. of Phys., Univ. of Lancaster, Lancaster, England).
Appl. Phys. Lett. (USA), vol.42, no.8, p.685-7 (15 April 1983).
The very rapid temperature dependence between 1 and 4K of the resistivity of GaAs bolometers was found to follow $\rho \sim \exp(AT^{-1/4})$. The most plausible attribution of this behavior was to variable range, single particle, and the data were consistent with the model of Apsley and Hughes. (14 refs.)

70113 Invisible—yet seen. Nocturnal vision equipments for the near-infrared range. K.Brun (Military Sci., ETH Zurich, Zurich, Switzerland).
Funkschau (Germany), no.7, p.53-6 (31 March 1983). In German.
Presents a survey of passive and active IR sighting instruments, illustrated by 8 diagrams/drawings. After dealing with the spectra and windows in the visible and adjacent IR ranges and the relevant atmospheric attenuation, various shortwave IR instruments (0.7 to 1.5 μm band) and thermal-imaging devices in the far IR band (3 to 15 μm) are described. A more detailed treatment of an active nocturnal sight equipment follows; it utilizes an IR searchlight and the photoemission (external) effect to obtain a visible image of the reflection at the eyepiece of an image converter tube. A passive instrument is described next, containing a 3-stage photo-multiplier with fibre optics input-, intrastage coupling- and output lenses. A more advanced converter tube contains a secondary electron multiplier/amplifier and separate tubular micro-channels; it requires 5-8 kV. Brief information is supplied on thermal-imaging devices, using the photoconductive (inner) effect for target detection in the air and on the ground. (no refs.) *A.L.*

70114 Pyroelectric radiation detectors. Y.Nakagawa (Illuminating Engng. Inst. of Japan, Tokyo, Japan).
J. Illum. Eng. Inst. Jpn. (Japan), vol.67, no.1, p.9-12 (Jan. 1983). In Japanese.
Optical detectors based on the pyroelectric effect are commercially available. Typical pyroelectric materials used as an optical sensor element are TGS, $PbTiO_3$, $LiTaO_3$, PZT and PVF_2. TGS and $LiTaO_3$ are suitable for point sensors. PZT and $PbTiO_3$ are stable at high temperatures. The author describes the equivalent circuit and frequency response of sensors and illustrates typical sensor structures and detection circuits. Examples are given of a light emission detector, infrared detector and infrared visicon. (13 refs.) *K.B.*

Light measurement many ways ....See Entry 70099

Small cryostat for cooling a photomultiplier .... See Entry 70101

Standing wave sensor ....See Entry 70109

A semiconductor detector for measuring ultraweak fluorescence decays with 70 ps FWHM resolution .... See Entry 70118

High resolution submillimeter-wave radiometry of supersonic flow ....See Entry 71593

Characteristics of a photodiode matrix for use with weak light fluxes ....See Entry 71795

Dielectric and pyroelectric properties of doped triglycine sulphate crystals [for infrared detectors] ....See Entry 72742

07.65 OPTICAL SPECTROSCOPY AND SPECTROMETERS

(inc. photoacoustic spectroscopy)

70115 Photoacoustic spectroscopy in crystalline semiconductors. H.Tokumoto (Electrotech. Lab., Ibaraki, Japan).
Bull. Electrotech. Lab. (Japan), vol.47, no.2, p.97-108 (1983). In Japanese.
See also ibid., vol.47, no.2, p.109-21 (1983). Photoacoustic measurements were made on single crystals of Si, Ge, InSb, GaAs and GaP by a gas-microphone method. Extensive measurements were made on GaAs samples, laying emphasis on the effects of the sample thickness, damaged surface layer, impurity concentration and thermal resistance at the sample gas interface on the photoacoustic signals. A successful interpretation of the overall experimental results with the aid of Resencwaig-Gersho theory indicates a possible application of photoacoustic spectroscopy to characterization of semiconductors. (19 refs.)

70116 Theory of photoacoustic spectroscopy in solids—gas-microphone method. H.Tokumoto (Electrotech. Lab., Ibaraki, Japan).
Bull. Electrotech. Lab. (Japan), vol.47, no.2, p.109-21 (1983). In Japanese.
Theoretical and quantitative treatment of photoacoustic effects orginating from internal heating as a result of light absorption was made for application of photoacoustic spectroscopy in determining the thermal and optical properties of solids. The most fundamental and widely-used theory by Rosencwaig and Gersho and its calculated results are shown. The characteristic signals detected by a gas-microphone method are described. Effects of the thermal resistance at the sample-gas interface, the mechanical vibration of the sample, and the layered structure of the sample are also discussed. (43 refs.)

70117 Picosecond streak camera fluorometry. A review. A.J.Campillo (Optical Sci. Div., US Naval Res. Lab., Washington, DC, USA), S.L.Shapiro.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.585-603 (April 1983).
A general tutorial survey is presented describing the use of ultrafast streak cameras in picosecond fluorometry. Current instruments exhibit time resolutions of 1-10 ps with detection sensitivities of a few photoelectrons. When linear photoelectric recording is employed, a real-time direct display of optical transients is provided. Representative examples from the literature in physics, chemistry, and biology are given, as well as an extensive bibliography. (155 refs.)

70118 A semiconductor detector for measuring ultraweak fluorescence decays with 70 ps FWHM resolution. S.Cova, A.Longoni (Istituto di Fisica, Politecnico di Milano, Milano, Italy), A.Andreoni, R.Cubeddu.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.630-4 (April 1983).
The performance of a new single-photon avalanche photodiode particularly suitable for the detection of fast and ultraweak light pulses is described. The advantages of this device over other available detectors are discussed. The electronic circuitry developed allows the measurement of fluorescence decays with a time resolution of 70 ps FWHM (full-width at half-maximum) and a data acquisition rate of up to 50 kHz. (21 refs.)

70119 Measurement conditions for continuously recording picosecond pump-and-probe spectrometers. T.Damm, W.Triebel, B.Wilhelmi (Dept. of Phys., Friedrich-Schiller Univ., Jena, Germany).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.635-8 (April 1983).
The measuring procedure of continuously recording picosecond pump-and-probe spectrometers is analyzed. The distortion of the input signal because of the finite pulse duration of probe pulses and because of the impulse response of the recording device is calculated. The influence of fluctuations of the output parameters of mode-locked dye lasers on the accuracy of measurements is considered. Measuring conditions such as choice of scan velocity and characteristic time of low-pass filters are discussed with respect to the condition that the resulting error should be a minimum. (7 refs.)

70120 Pulsed source of an optical comparison spectrum of high brightness. V.P.Novikov, V.S.Smirnov (Physicotech. Low-Temperature Inst., Acad. of Sci., Khar'kov, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1006-7 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.204-5 (July-Aug. 1982). [received: May 1983]
Describes a source of an optical comparison spectrum of increased brightness; the source makes use of a stable iron Pfund arc in pulsed operation. (4 refs.)

70121 Scanning mirror device with frequency matching for the DFS-13 spectrograph. V.P.Novikov, V.S.Smirnov, V.V.Eremenko (Physicotech. Inst. of Low Temperature, Acad. of Sci., Khar'kov, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1011-15 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.209-12 (July-Aug. 1982). [received: May 1983]
Describes a scanning mirror device incorporated in the DFS-13 spectrograph for photoelectric recording of spectral sections of ~40 mm in the focal plane of the instrument (~80 and ~160 Å for gratings of 1200 and 600 lines/mm, respectively). The scanning time is 60 μsec. Together with two adjustable frequency marks outputted by the device, the spectrum is recorded on an oscilloscope screen. (2 refs.)

70122 Photoacoustic spectroscopy. T.Ishiguro (Electrotech. Lab., Ibaraki, Japan).
J. Inst. Electron. & Commun. Eng. Jpn. (Japan), vol.66, no.1, p.27-32 (Jan. 1983). In Japanese.
Photoacoustic spectroscopy is a spectroscopic technique which illuminates a solid or semisolid material sample with monochromatic radiation intensity modulated at some suitable acoustic frequency; absorption of radiation results in a periodic heat flow from the sample, which generates sound that directly relates to absorption of radiation and is detected by a sensitive microphone. This paper outlines practice for photoacoustic spectroscopy, and its application to evaluating semiconductor materials and to photoacoustic microscopes. (16 refs.) *K.B.*

Formulas, facts and constants. For students and professionals in engineering, chemistry and physics .... See Entry 69803

Notes on the method of fluorescence and phosphorescence measurements—by the use of Hitachi MPF 4 fluorescence spectrophotometer ..... See Entry 70098

High-resolution laser spectroscopy of alkali atoms .... See Entry 70824

Fringe benefits: applications of holographic elements .... See Entry 71088

Probability distribution of photocounts of the light scattered by critical fluctuations .... See Entry 71096

07.65E UV and visible spectroscopy and spectrometers

70123 Statistical estimates of spectroscopic parameters in multichannel detection of weak optical spectra. S.L.Nitsolov (Inst. of Electronics, Bulgarian Acad. of Sci., Sofia, Bulgaria).
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.78-86 (1983).
Optimum statistical estimates of spectroscopic parameters measured by analysis of weak optical spectra detected by a multichannel photodetector have been obtained. The likelihood equations have been derived for the estimates in cases where the spectral intensity is a known function of the measured quantity and where the dependence of the spectral form on the unknown parameter is known. When the noise is considerably weaker than the signal, approximations for the maximum likelihood estimates may be used, the approximations being of fair accuracy and easy to calculate. As an illustration of the applications of the results estimates are made of gas concentrations measured by a Raman lidar. The results obtained here may be used to optimize the processing of spectroscopic data in multichannel detection. (6 refs.)

70124 Picosecond spectrochronography. A.Freiberg, P.Saari (Inst. of Phys., Acad. of Sci., Tartu, Estonian SSR).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.622-30 (April 1983).
The general problem of extracting complete (amplitude and phase) information out of an optical signal is discussed. It is shown that the best one can do to determine all essential features of light pulses is to apply simultaneous temporal and spectral analysis to take spectrochronograms with the appropriate shape of the resolution cell on the ωt-plane. The term 'spectrochronogram' is used instead of the much broader term 'time-resolved spectrum' for a specific measurement result where the resolutions $\Delta\omega$ and Δt used are transform correlated. A novel subtractive mount of monochromators has been proposed to overcome the obstacles to experimental realization of uncertainty-principle-limited setups for high spectral resolution picosecond spectrochronography. For the examples of perylene and anthracene molecules, experimental spectrochronograms revealing temporal behavior of hot luminescence lines and, correspondingly, picosecond kinetics of intramolecular vibrational relaxation have been presented. (29 refs.)

70125 Unified supply source for lamps used in ultraviolet spectroscopy. R.R.Vardapetyan, S.A.Terzikyan, P.O.Vardevanyan, G.A.Panosyan (Erevan State Univ., Erevan, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.968-70 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.170-1 (July-Aug. 1982). [received: May 1983]
A miniature economical source of light is described for use in lamps employed in UV spectroscopy, with stabilized anode and heater currents. The instability of the output current is $\leq 0.5\%$ with variations in supply voltage of $\pm 10\%$ and temperatures from 10 to 40°C. The dimensions of the unit are $180 \times 150 \times 150$ mm. (2 refs.)

Simple mechanism for in situ adjustment of gratings in UHV monochromators .... See Entry 71222

07.65G IR spectroscopy and spectrometers

70126 Branch-selected infrared laser ring cavity for ultrahigh resolution spectroscopy. Huang Yong-kai (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.159-61 (Jan.-March 1983). [received: May 1983]
A simple method of branch selection is suggested and the beam parameters for the cavity are calculated. (7 refs.)

70127 A new approach to infrared spectroscopy. J.F.Williams (Perkin-Elmer, Ridgefield, CT, USA).
Photonics Spectra (USA), vol.17, no.3, p.59-62 (March 1983).
Probably the single most important advantage of Fourier transform infrared spectroscopy (FT-IR) is its high rate of data collection. In fact, the spectroscopist now has at his disposal user-interactive data systems and related software capable of further boosting the quality of FT-IR analysis. This speed advantage affords the analyst heretofore unequalled measurement capabilities in the areas of signal accumulation and averaging on micro samples, fast reaction kinetics, high sample throughput in the quality control environment, and on-the-fly detection of gas chromatography separations. The author examines one particular type of FT-IR system—the refractively scanned interferometer. The Perkin-Elmer model 1500 FT-IR is used as the example for this examination. Dual-beam operation and the advantages of a HgCdTe detector are discussed. (no refs.)

70128 Spectrograph for investigating spectra of pulsed infrared lasers. G.B.Gorlin, I.I.Komissarova, G.V.Ostrovskaya, Yu.I.Ostrovskii, L.G.Paritskii, V.N.Filippov, E.N.Shedova (Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1009-11 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.207-8 (July-Aug. 1982). [received: May 1983]
Describes a spectrograph for the photographic recording of pulsed infrared radiation spectra at wavelengths exceeding the sensitivity range of conventional photographic materials. The spectrograph was assembled in the standard configuration with mirror optics (f=60 cm) and a diffraction grating (50 lines/mm). For the recording, photographic material was illuminated by a pulsed source of actinic radiation, the source being synchronized with the infrared radiation source to be examined so that a thermal relief is produced on the photographic material. The recording sensitivity is 10^{-2} J/cm^2. The spectra of a pulsed CO_2 laser with a double transverse discharge were obtained in the spectrograph. (5 refs.)

70129 Spectral resolution of a proustite upconverter as an infrared spectrometer. K.Koyanagi, I.Sakuraba (Faculty of Engng., Hokkaido Univ., Sapporo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.2, p.163-4 (Feb. 1983). In Japanese.
The spectral resolutions of an upconverter-spectrometer in the 10 μm spectral region, using a proustite crystal and a Nd:YAG laser as the pump, are described. The resolving power ($\lambda_{ir}/\Delta\lambda_{ir}$) of 2.2×10^2 is obtained for a 9.4 mm length crystal. (4 refs.)

07.68 PHOTOGRAPHY, PHOTOGRAPHIC INSTRUMENTS AND TECHNIQUES

(for light sensitive materials see also 42.70)

70130 3M colour reversal 1000—a review. G.Ashton.
Br. J. Photogr. (GB), vol.130, no.17, p.445-5, 459 (29 April 1983).
3M Colour Reversal 1000 film is balanced for exposure in daylight with a nominal colour temperature of 5500K and is thus suitable for existing light photography where the primary source of illumination is daylight. Both sensitometric and camera exposures were made on Colour Reversal 100 film in testing and to provide a datum line for speed and colour balance, similar exposures were made on the nearest comparison material from another manufacturer—Ektachrome 400. The characteristic curves for 3M Colour Reversal 1000 film plotted from sensitometric exposures show good or even excellent conformity with only a slight difference in the contrast of the toe of the blue-sensitive emulsion to contradict this general statement. Judged on the neutral grey scale of the Macbeth ColorChecker both the 3M Colour Reversal 1000 and the Kodak Ektachrome 400 films show a very similar neutral balance—the 3M film with slightly bluish highlights and the Kodak film slightly greenish highlights; neither is excessive nor objectionable. When transparencies made on 3M Colour Reversal 1000 film are projected to a reasonable size and viewed from a comfortable distance for the screen dimensions the graininess of the image is just perceptible. Examination of the sharpness of the 3M film by assessment of the high contrast resolving power chart on projection demonstrates that the manufacturers' claim for high sharpness is justified and for its speed Colour Reversal 1000 film is very crisp. (no refs.)

70131 Kodacolor VR 1000 film. H.Denstman.
Ind. Photogr. (USA), vol.32, no.2, p.22, 24, 49 (Feb. 1983).
Reports the development of a new high-speed negative color film—Kodacolor VR-1000, which represents a dramatic advance in silver-halide emulsion technology. Kodak's new film represents a radical departure in grain structure, for compared with conventional high-speed silver-halide emulsions which contain relatively large, irregularly shaped light-sensitive silver salts, Kodacolor 1000 employ, a 'smooth' tablet shaped silver-halide grain that appears to be flat. The new grains maximise the absorption of incoming light resulting in a more sensitive imaging medium without any increase in silver content. The tablet shaped 'T-grain' offers greater light sensitivity with better sharpness than was previously possible and the flattened grain results in a more light-sensitive emulsion without a difference in graininess. The new film technology has also made it possible to eliminate the interdependence between speed grain and sharpness, which has in the past accompanied improvements in one area with penalties in one or both of the others. Other advances incorporated in the film include improved coupler/image dye technology and use of a modified inverted layer format is a configuration in which the fastest light-sensitive layers are positioned nearer to the camera lens, followed by the slower layers. (no refs.)

70132 Optical effects for film and video. J.Manilla.
Ind. Photogr. (USA), vol.32, no.2, p.27-9 (Feb. 1983).
Outlines the techniques available for producing optical effects for the video and film industries. For the video industry these range from the Digital Production Effect 5000 series video effects generator, which allows the operator to manipulate the picture on the screen in real-time, through simply using 'joy stick' and push button controls, thus enabling him to see exactly what is happening on the screen, through to the latest Mirage system, which can now take a flat two-dimensional picture and electronically convert it into a three-dimensional image. With the film industry, because of the requirements for film exposure, development and printing, one loses the real-time facility of the video generator and the motion picture optical effects are produced by a number of stages, which lead to the production of computer-generated drawings which are photographed on film, and the colours are added and controlled by color filters. With film one is working with a chromatic range which is superior to the limited range that video can generate and this enables one to get a better chromatic range and more subtle colours. Also the possibilty of 'multiple runs' on the same piece of film, enable one to achieve very complicated and precise 'matched' moves. (no refs.)

70133 PVCz/HgS double layer structure for electrophotography. Navneet, P.K.C.Pillai (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
J. Mater. Sci. (GB), vol.18, no.5, p.1577-81 (May 1983).
Xerographic characteristics of the double layer structure PVCz/HgS have been evaluated. These characteristics for the double layer have been compared with those for the single layer of HgS pigment and acrylonitrile-butadiene-styrene resin. Acceptance potential, fractional dark and photoinduced decrease, contrast potential, and relative spectral sensitivity are the most important characteristics studied. The double layer shows a maximum surface potential of 1632 V and 93% fractional decay of surface potential under illumination (intensity being 8.5 mW cm^{-2}), calculated 10 sec after the start of illumination. The spectral sensitivity is nearly panchromatic from 460 to 530 nm with a sensitivity peak at 585 nm in the visible region. (17 refs.)

70134 Using the video signal to control the intensity of the illumination for an endoscope video camera. J.Kullmann, H.Hartig (VEB Werk fur Fernsehelektronik, Berlin, Germany).
Radio Fernsehen Elektron. (Germany), vol.32, no.2, p.73-5 (1983). In German.
The authors explain that the inside of the object to be photographed has to be illuminated from an aperture, via a light conducting cable, connected close to the endoscope aperture. Because the endoscope is moved during the video recording process, the illumination of an area to be recorded can be insufficient. After explaining how illumination was controlled when using Videcon cameras, the authors describe a much more efficient 'hybridendikon' camera, which, however, requires that the illumination of the object to be examined must be differently controlled. The video signal amplitude is increased and decreased as the illumination provided becomes dimmer and brighter. Rectification of this signal with an appropriate time constant produces a control voltage proportional to the intensity of the illumination required. By reversing the phase of the signal in the control circuit, an increasing illumination will cause the voltage controlling the illuminating light to be reduced and vice versa. The article describes in detail the circuit used and discusses practical applications of it. (2 refs.) *G.W.*

70135 Enzymatic photography. I.V.Berezine, N.F.Kazanskaya (Inst. of Biochem., Acad. of Sci., USSR).
Recherche (France), vol.14, no.144, p.708-10 (May 1983). In French.
Photography itself is in the course of changing. Research on new photosensitive supports gives rise to the hope that photography using silver salts may be replaced by enzymatic photography. This will both reduce costs and conserve

silver. The paper describes recent work in Russia on the actions of enzymes on film. The production of substratae which are light sensitive is first described. Then follows a description of the transition from rendering a film photosensitive to enzymes to the production of an image. The process of fixing the enzymes after taking a picture is explained, the film used being a sandwich of three layers. The last section discusses whether enzymatic photography has now arrived to stay. (14 refs.) *G.V.D.*

70136 A new method of magnifying photographic images using the scanning electron microscope in the backscattered electron detection mode. P.Frasca (Dept. of Orthopaedic Surgery, Thomas Jefferson Univ., Philadelphia, PA, USA), B.Galkin, S.Feig, H.Muir, R.Soriano, H.Kaufman.
Scanning Electron Microsc. (USA), pt.3, p.917-23 (1982).
Describes a new method of magnifying small images in photographic film by means of a scanning electron microscope (SEM) operated in the backscattered electron detection mode. The study included tests of several types of radiographic film, transmission electron microscopy film, and black and white 35 mm film. The electron optical enlargement method is particularly useful in situations where the film sample is opaque to light and for generating enlarged images at magnifications beyond the reach of light optical enlargement methods, i.e. up to ~2000×, with ease and rapidity in a single step. The electron optical enlargements compare favorably in contrast and detail with the enlargements made with a light microscope and with a darkroom enlarger. (7 refs.)

Picosecond streak camera fluorometry. A review .... See Entry 70117

Underwater photography of magnetic particle inspection results ....See Entry 73290

07.75 MASS SPECTROMETERS AND MASS SPECTROMETRY TECHNIQUES

(for mass spectroscopic chemical analysis, see 82.80)

70137 A very sensitive electro-optical simultaneous ion detection system. G.J.Louter, A.N.Buijserd (FOM-Inst. for Atomic & Molecular Phys., Amsterdam, Netherlands).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.245-57 (15 May 1983).
A fully operational, electro-optical system for simultaneous detection is discussed. This system is applied to the simultaneous detection of mass spectra, obtained by collision-activated dissociation experiments. The detector itself consists of a chevron arrangement of two channel plates, phosphor screen, fibre optics, camera objective and photodiode array. It forms part of an extensive information system, which controls the photodiode array and performs data processing as, for example, background subtraction and correction of the spectrum for spatial sensitivity variations of the detector. The detection system is characterized by a very low noise rate with an average value of about one dark ion per 250 s for each mass peak in the spectrum. The dynamic range of peak heights in a simultaneously detected spectrum can be up to 3.3×10^4 at a signal to noise ratio of 1. The reproducibility of peak area measurements is better than 20% over the entire length of the detector. Several characteristics of the detection system and the data processing is discussed. Attention is given to variations of the spatial sensitivity and to loss of spatial resolution, both of which may occur in this type of system. (14 refs.)

70138 An elongated trapped-ion cell for ion cyclotron resonance mass spectrometry with a superconducting magnet. R.L.Hunter, M.G.Sherman, R.T.McIver,Jr. (Dept. of Chem., Univ. of California, Irvine, CA, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.259-74 (15 May 1983).
A one-region trapped-ion analyzer cell that is elongated in the dimension parallel to the magnetic field is described and shown to be well suited for ion cyclotron resonance (ICR) experiments using a solenoidal-geometry superconducting magnet. An analysis of the static electric fields inside the elongated cell shows that the resonance frequency of the ions is far less affected by the trapping voltages than with a cubic cell or the original trapped-ion cell. The main advantage of the elongated cell are improved mass measurement accuracy and increased dynamic range. (27 refs.)

70139 Operational features resulting in mass spectrometers from NPM-0.1 vapor-jet vacuum pumps. V.I.Ermolov, Yu.S.Kusner, K.M.Moskalenko (Inst. of Thermophys., Acad. of Sci., Novosibirsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.992-4 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.192-3 (July-Aug. 1982). [received: May 1983]
Distortions which develop in a mass spectrum when the ion source of the mass spectrometer is evacuated with an NPM-0.1 vapor-jet pump are considered. It has been shown in the experiments that, under typical conditions, the pumping rate is a function of the outlet pressure and the molecular mass of the component under consideration. Errors which are made in measurements of the intensity ratio of the mass spectrum lines can reach the order of magnitude of the square root of the ratio of the component masses. Several practical recommendations for eliminating the mechanism leading to the distortion of a spectrum are discussed. (8 refs.)

70140 Calibration of a mass spectrometer in static operation. E.V.Popov, A.Ya.Kupryazhkin (Urals Polytech. Inst., USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.994-6 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.194-5 (July-Aug. 1982). [received: May 1983]
A method is proposed of calibrating an MI-1305 mass spectrometer in static operation by expanding the gas from a small volume into a large volume and using a capacitive micromanometer. A ^{4}He sensitivity of the mass spectrometer of ^{4}He $\gamma = (4.1 \pm 0.1) \times 10^{-7}$ Pa/mV was obtained. (5 refs.)

70141 Ion source of ROMS-2 mass spectrometer with fragmentless ionization. N.N.Ledneva, Kh.I.Pruger, A.A.Rivlin.
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1025-6 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.222-3 (July-Aug. 1982). [received: May 1983]
A modernised ion source for the ROMS-2 mass spectrometer is described which, allows mass spectra to be obtained without molecular fragments. (no refs.)

70142 A new accelerator-based mass spectrometry. H.E.Gove (Nuclear Structure Res. Lab., Univ. of Rochester, Rochester, NY, USA).
Phys. Teach. (USA), vol.21, no.4, p.237-45 (April 1983).
A new and important practical use has recently been made of accelerators that are normally employed for basic research on the properties of the atomic nucleus. These machines are called tandem electrostatic accelerators and they produce beams of energetic positive ions. These ions are used to penetrate the nucleus of atoms in a target thereby inducing a variety of nuclear reactions whose detailed study elucidates the varied properties of the nucleus. A tandem accelerator begins by producing a negative ion. These ions are attracted to the positive terminal of the accelerator through an evacuated tube and arrive there with velocities that are 2 to 3% of the velocity of light. Inside the positive terminal, the ions pass through a thin foil or a gas-filled canal where they suffer collisions with the atoms of the foil or gas. In these collisions, they change from singly charged negative ions to multiply charged positive ions. They are then accelerated away from the terminal through the second half of the tandem and arrive back at ground potential traveling even faster (with velocities close to 10% of the velocity of light). At this stage they are accurately energy-analyzed and directed toward the target by magnetic and electric deflecting fields. The whole system acts like a mass spectrometer. (3 refs.)

70143 A small universal quadrupole mass spectrometer. I.Berecz, S.Bohatka, J.Gal, L.Kiss, G.Langer, A.Paal, R.M.Kovacs (Inst. of Nuclear Res., Hungarian Acad. of Sci., Debrecen, Hungary).
Vacuum (GB), vol.33, no.1-2, p.69-70 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
A universal quadrupole mass spectrometer (type Q60U) has been constructed for general laboratory and industrial purposes. Its 10 cm long analyser rod system, 1-60 amu mass range and 4.10^{-4} A mbar^{-1} sensitivity make it a good residual gas analyser. Due to its high mass resolution it can be used also as an analytical instrument. It works as a total pressure gauge too, saving the cost of a vacuum gauge. The bias and gain controls and audio-frequency signal generator of its leak detection unit complete the quadrupole as a sensitive multi-test gas leak detector. (2 refs.)

70144 Peak selector for quadrupole mass spectrometer. I.Berecz, S.Bohatka, Z.Dios, G.Langer (Inst. of Nuclear Res., Hungarian Acad. of Sci., Debrecen, Hungary).
Vacuum (GB), vol.33, no.1-2, p.87-8 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
A modern construction peak selector based on digital techniques has been constructed. The instrument can be extended to a maximum of nine signal channels selecting the ion-current with the help of thumbwheel switches. In the first channel it is possible to set the full mass range, while in each one of the other eight channels a width of a maximum of nine atomic mass units can be set. The instrument has got a mass identifier circuit and optionally each channel has a fast analog signal processing unit. The peak selector can be coupled to any kind of quadrupole mass spectrometer with a maximum mass range up to 512 amu. (1 ref.)

Formulas, facts and constants. For students and professionals in engineering, chemistry and physics ....See Entry 69803

Leak detection of high pressure vessels ....See Entry 70071

Analytical evaluation of ternary thermodynamics from investigations by Knudsen-cell mass spectrometry ....See Entry 72136

Atmospheric pressure ion evaporation-mass spectrometry ....See Entry 73384

Comments on accuracy in mass-spectrometric gas analysis .....See Entry 73393

07.77 PARTICLE BEAM PRODUCTION AND HANDLING; TARGETS

(see also 29.25 in elementary-particle and nuclear physics, 41.80 Particle beams and particle optics)

70145 Measurement of virtual crossover in liquid gallium ion source. M.Komuro, T.Kanayama, H.Hiroshima, H.Tanoue (Electrotech. Lab., Ibaraki, Japan).
Appl. Phys. Lett. (USA), vol.42, no.10, p.908-10 (15 May 1983).
Gallium ion probes of 50 keV obtained from a liquid metal ion source are recorded on silicon and gallium arsenide substrates by using the method of ion bombardment enhanced etching. The minimum linewidth obtained in line exposures is about 20 nm for both substrates which corresponds to the lateral spread of the implanted ions. For a specified value of the lens acceptance half-angle, the line dose varies as a square function of the linewidth, which means that distribution of the current density in the focused beam is Gaussian. From the theoretical evaluation of the full widths at half-maximum of these distributions, the virtual crossover diameter of the source is estimated to be 40-45 nm independently of the emission current ranging from 4 to 12 μA, and of the value of the needle apex radius of the source in the range 1-3 μm. (7 refs.)

70146 Development status of a cesium field emission thruster. J.P.Bugeat, D.Valentian (SEP Space Div., Vernon, France).
Acta Astronaut. (GB), vol.9, no.9, p.581-2 (Sept. 1982). [received: March 1983]
A laboratory field emission thruster has been developed and tested using cesium as a propellant. Extensive testing has been performed with positive pressure feeding and ion optics distance variation. Thrust is higher than 1 mN. (5 refs.)

70147 Flight time of relativistically fast particles in crossed toroidal electric and inhomogeneous magnetic fields. H.Nakabushi (Dept. of Phys., Osaka Univ., Toyonaka, Japan), T.Sakurai.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.275-86 (15 May 1983).
The second-order flight time deviations of charged particles moving with relativistic energies in crossed toroidal electric and inhomogeneous magnetic fields have been calculated. The results can be used for superimposed or pure electric and magnetic fields as well as for Wien filters. (4 refs.)

70148 Device for measuring the energy reflection coefficient in charged-particle bombardment of a metal. N.N.Koborov, V.A.Kurnaev (Moscow Engng. Phys. Inst., Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.971-5 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.173-6 (July-Aug. 1982). [received: May 1983]
A device and a simple method of measurement are described for measuring the energy reflection coefficient R_E for a metal target bombarded by a charged-particle beam at any angle. The temperature transducers for the target and heater are unencapsulated silicon transistors. The absolute error in determining R_E is not more than ± 0.025. (7 refs.)

70149 Pulse transformer drive circuit for a molecular-beam source. R.J.Rorden, D.M.Lubman (Quanta-Ray Inc., Mountain View, CA, USA).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.641-3 (May 1983).
The authors introduce the use of a pulse transformer as an improvement in the drive circuit of the 'hairpin loop' design for a pulsed molecular-beam source. The virtue of this device is that it can produce the high currents

necessary to drive the hairpin at low voltage. In addition, it minimizes the I^2R power loss of former designs while allowing for proper impedance matching of the leads to the power supply, thus lowering the voltage requirements necessary to drive the circuit. (24 refs.)

70150 Application of physical effects for the detection of small ion currents in vacuum. K.H.Krebs (Zentralinst. fur Elektronenphys., Akad. der Wissenschaften, Berlin, Germany).
Vacuum (GB), vol.33, no.1-2, p.7-11 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
In many fields of experimental physics (e.g. mass spectrometry, analysis of solids, nuclear physics, etc.), it is necessary to detect small ion currents ($<10^{-16}$ A) in vacuum. Generally, ion-electron converters are used for this purpose. The working principle of these converters is determined by the physical effect of ion-induced kinetic electron emission from solids. After presentation of the details of particular equipment, the parameters affecting the electron emission are discussed. The effects of these parameters on the two possible detection methods—current measurement and pulse counting—are treated. Specific attention is given to the statistics of electron release and its effect on the detection probability. (25 refs.)

Ion source of ROMS-2 mass spectrometer with fragmentless ionization ....See Entry 70141

Continuous-running electron gun with a large-area plasma cathode ....See Entry 70152

Atmospheric pressure ion evaporation-mass spectrometry ....See Entry 73384

07.80 ELECTRON AND ION MICROSCOPES AND TECHNIQUES

(see also in condensed matter 61.16D Electron microscopy, 61.16F Field ion microscopy)

70151 Tunneling current microscopy. P.S.D.Lin, H.J.Leamy (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.717-19 (15 April 1983).
The field dependence of electron beam induced current in thin oxide (22.5 nm) capacitors has been studied with a view of using the induced current for detecting defects in such devices. Results indicate that the induced current follows Fowler-Nordheim tunneling behavior when the field exceeding 4 MV/cm, and that a certain type of defect in thin oxide capacitors can be imaged with high contrast and low noise. A high current gain ($\sim 10^3$) of the induced current was also obtained. These findings open the possibility of acquiring information on the quality and reliability of composite metal-insulator-metal/semiconductor structures, and of achieving a high current for signal amplification. (9 refs.)

70152 Continuous-running electron gun with a large-area plasma cathode. Yu.E.Kreindel', V.Ya.Martens, V.Ya.S'edin, S.V.Gavrintsev (Tomsk Inst. of Automatic Control Systems & Electronics, Tomsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.977-9 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.178-80 (July-Aug. 1982). [received: May 1983]
A description is given of an electron gun with a plasma cathode that produces an electron beam of diameter 100 mm with a nonuniformity of $\leq +6\%$ in the distribution of the current density over the cross section and a current up to 0.5 A for an accelerating voltage up to 15 kV. The plasma emitting surface is produced by the penetration of charged particles from a low-voltage hollow-cathode discharge into an expander. The beam acceleration and formation are provided by a multiaperture electrooptical system. (5 refs.)

70153 Optimisation of electron energy analysers for application in coincidence experiments. M.Volkel, W.Sandner (Fakultat fur Phys., Univ. Freiburg, Freiburg, Germany).
J. Phys. E (GB), vol.16, no.5, p.456-62 (May 1983).
The coincidence width in electron-particle coincidence experiments is investigated in detail. It is shown that, since the advent of channel plates replacing channeltrons, the major contribution comes from different flight paths inside the electron energy analysers. Two different methods are presented for compensating this time spread; in a first experimental application a reduction by more than a factor of 6 in the coincidence width was achieved. (36 refs.)

70154 Jump ratio as a measure of spectrometer performance. R.F.Egerton (Phys. Dept., Univ. of Alberta, Edmonton, Canada), J.Sevely.
J. Microsc. (GB), vol.129, pt.3, p.RP1-2 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
Increaasing numbers of transmission electron microscopes have been equipped with an electron energy-loss spectrometer, largely for microanalysis of low-atomic-number elements via the measurement of inner-shell ionization edges. For good elemental sensitivity, an important experimental parameter is the energy resolution of the spectrometer, for a given range of entrance angles. However, another desirable property is a low background in the energy-loss spectrum. However, an additional instrumental contribution can originate from within the electron-optical system; in the case of serial recording, this arises mainly from electron backscattering at the detector slit and from X-ray generation at the slit. A convenient estimate of total (instrumental+specimen-generated) background is obtained by measuring the jump ratio at a suitable ionization edge. Evaporated films of amorphous carbon form a suitable test specimen, since these are readily prepared and give a K-ionization edge which is easy to measure. (6 refs.)

70155 Methods of amplifying magnetic contrast type I in scanning electron microscope. A.Walczak.
Pr. Inst. Tele- & Radiotech. (Poland), no.92, p.34-44 (1983). In Polish.
The paper deals with the conditions and methods for amplifying contrast of the magnetic domains picture obtained in the signal of secondary electrons (type I) in scanning electron microscope (SEM). The effect of geometrical and electronic parameters on the contrast level is discussed. Some applications examples are also given. (6 refs.)

70156 Electron beam blanking systems. H.Fujioka, K.Ura (Electron Beam Lab., Osaka Univ., Osaka, Japan).
Scanning (Germany), vol.5, no.1, p.3-13 (1983).
Electron beam blanking in the scanning electron microscope (SEM) by deflection over a chopping aperture is reviewed. The first part is connected with electron beam deflection structures and driving methods, the second part with the electron optics of deflection blanking systems in the SEM. (36 refs.)

70157 Signal mixing techniques in scanning electron microscopy. B.Volbert (S&I Electron Optics Applications Lab., NV Philips' Gloeilampenfabrieken, Eindhoven, Netherlands).
Scanning Electron Microsc. (USA), pt.3, p.897-905 (1982).
Separation of different contrasts (i.e. material and topographic contrast) using a 2-detector system (A,B) can be obtained by signal mixing (A+B, A−B) in the backscattered electron (BSE) mode. Imaging a multicompositional specimen at high primary electron (PE) energies, the BSE(A−B) micrographs show a pseudotopography which is caused by anisotropic backscattering of the BSE at the material boundaries. In addition the resolution of the true surface topography is very poor due to the large information depth of the BSE. Using two oppositely placed Everhart-Thornley detectors and a grid above the specimen, true surface imaging is also possible at high PE-energies in the SE(A−B) mode, in which the two SE-signals are subtracted. A multi-function-detector system (MFD) in combination with the normally used Everhart-Thornley detector allows the simultaneous detection of SE and BSE. Therefore the generation of the signal (SE-BSE) is possible. Due to the fact that the BSE- or depth-information in the (SE-BSE) signal is suppressed the latter signal shows a smaller information depth compared with the SE-signal. Also the material contrast fully disappears. The (SE-BSE) signal gives the 'true' topography of a multicompositional specimen at high PE-energies without any artefacts. Depth characterisation of information is possible by using the BSE(A+B) signal for subsurface information and the (SE−BSE) signal for surface information. (18 refs.)

70158 Voltage contrast isolation by frame-by-frame subtraction in the scanning electron microscope. H.Fujioka, M.Tsujitake, K.Ura (Electron Beam Lab., Osaka Univ., Osaka, Japan).
Scanning Electron Microsc. (USA), pt.3, p.1053-60 (1982).
A method for isolating voltage contrast by frame-by-frame digital processing has been developed. The SEM images of various different states of a tested device, e.g. images at unbiased and biased states or several stroboscopic images at different phases, are sampled and stored in a microcomputer. Then, the system allows the isolation of voltage contrast changes between any two stored images by frame-by-frame digital processing. The basic feature over other methods is the separation of image acquisition and voltage contrast isolation which increases the system flexibility: different types of processing such as subtraction, normalization, or gray-level display can be carried out after the image data acquisition is terminated. Furthermore, the separate operation can reduce the interaction time between the electron beam probe and the tested device. (16 refs.)

MICRO 82: High Resolution Electron Microscopy ....See Entry 69778

A new method of magnifying photographic images using the scanning electron microscope in the backscattered electron detection mode ....See Entry 70136

A very sensitive electro-optical simultaneous ion detection system ....See Entry 70137

Device for measuring the energy reflection coefficient in charged-particle bombardment of a metal ....See Entry 70148

Problems of interpretation in high resolution electron microscopy ....See Entry 71843

The STEM approach to the imaging of surfaces and small particles ....See Entry 71844

The use of moire techniques to measure rigid body displacements ....See Entry 71845

Electron beam-solid interactions: implications for high spatial resolution Auger electron spectroscopy ....See Entry 72897

Design and operation of a high efficiency magnetron sputter coater ....See Entry 72990

Instrumentation and methods for scanning Auger microscopy . See Entry 73309

Atmospheric pressure ion evaporation-mass spectrometry ....See Entry 73384

07.85 X-RAY, GAMMA-RAY INSTRUMENTS AND TECHNIQUES

70159 A soft X-ray streak camera. G.L.Stradling (Lawrence Livermore Nat. Lab., Livermore, CA, USA), D.T.Attwood, R.L.Kauffman.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.604-15 (April 1983).
A soft X-ray streak camera is presented which offers wide application for picosecond recording of transient signals in the spectral range from the VUV to the very hard X-ray region. Specific demonstration results are presented from laser-fusion diagnostic studies. Dynamic characterization of the streak camera, new photocathode studies, and the application of intermediate and broad spectral selectivity techniques are discussed. (43 refs.)

70160 Quantitative intensity measurements using a soft X-ray streak camera. R.L.Kauffman (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.616-21 (April 1983).
A soft X-ray streak camera (SXRSC) has been calibrated in order to make absolute flux measurements of X-rays emitted from laser-produced plasmas. The SXSRC is used to time-resolve X-ray pulses to better than 20 ps. The SXRSC uses an Au photocathode on a thin carbon substrate which is sensitive to X-rays from 100 eV to greater than 10 keV. Calibrations are done in the dynamic mode using a small laser-produced X-ray source. The SXRSC is calibrated by comparing its integrated signal to the output of calibrated X-ray diodes monitoring the source strength. Details of the experiment along with data from a typical calibration are presented. The measured SXRSC intensity response is linear over greter than two orders of magnitude. Using these calibrations, absolute intensities can be measured to an accuracy of ±30 percent. An example of its use as a flux monitoring device is presented. (15 refs.)

70161 Photocathodes for X-ray electron-optical convertors. E.D.Baeva, E.I.Zak, L.I.Kondrashova, B.M.Stepanov, I.G.Tverdokhleb (All-Union Phys. Optics Res. Inst., Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.988-90 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.188-90 (July-Aug. 1982). [received: May 1983]
A method is described for flight measurement of the current quantum yield κ_c of metal, insulating, and double photocathodes for X-ray electron-optical converters (XEOC) for X-ray wavelengths λ of 1.5-1.7 Å. The quantum yields have been calculated from the pulse number and from the number of electrons in a pulse. The half-width ΔE of the electron energy distribution has been determined. The most efficient cathodes for XEOC are Au, CsI photocathodes and double photocathode systems with Cs_3Sb on Au and Cs_3Sb on CsI, which have κ_c in the range 0.15-0.6 electrons with $\Delta E = 15$-25 eV. (6 refs.)

70162 Use of an X-ray diffractometer to investigate fluorescence radiation. B.A.Mel'nik (Inst. of Casting Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1018-19 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.215-16 (July-Aug. 1982). [received: May 1983]
The DRON-2.0 X-ray diffractometer is used to carry out a fluorescence analysis. The specimen being investigated is placed in the holder of the monochromator unit, and the crystal analyzer is attached to the holder, which is on the axis of the goniometer. (2 refs.)

70163 Measurement of the energy spectrum of nanosecond X-ray pulses. L.Ya.Morgovskii, B.V.Kagan, O.S.Marnekov.
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1019-21 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.216-18 (July-Aug. 1982). [received: May 1983]
The energy spectra of the radiation of the MIRa pulsed X-ray apparatus using tubes with explosive electron emission have been measured. The filter method with selection of statistical data has been used. The spectra have been established using a version of the regularization method. (9 refs.)

70164 Multilayer films for soft X-ray optics. G.V.Marr.
Phys. Bull. (GB), vol.34, no.5, p.204-6 (May 1983).
The soft X-ray part of the electromagnetic spectrum lies between the vacuum ultraviolet and the conventional X-ray regions. It is defined by specifying a wavelength range of about 10-0.5 nm. Normal incidence reflectivities of simple surfaces are negligibly small at these wavelengths, and so it is common practice to use grazing incidence optics to focus the radiation. However the focusing properties of such cylindrical or toroidal mirrors are limited by severe aberrations, and monochromators have, at best, moderate resolution. Moreover, the general use of the radiation flux is inefficient. There is, therefore, a need for optical elements with usable reflectivities at near normal incidence. Progress reported at recent conferences suggests that multilayer films can meet these requirements and that the design and manufacturer of normal incident optical elements are technically feasible. This represents a big step forward for the soft X-ray optics used at synchrotron facilities (where, at present, 1 m long grazing incidence mirrors intercept and image the radiation), for soft X-ray astronomy and for studies of radiation from high temperature plasmas. (4 refs.)

70165 ZAP—a standardless X-ray microanalysis computer program. D.A.Gedcke, L.G.Byars, W.H.Hardy (EG&G ORTEC, Oak Ridge, TN, USA).
Scanning Electron Microsc. (USA), pt.3, p.981-93 (1982).
A computer program has been developed for standardless energy dispersive X-ray microanalysis of metal and oxide samples. The program includes automatic background subtraction, peak overlap correction including escape peaks, detector efficiency correction, and relative atomic, absorption, and characteristic line fluorescence corrections. The background model includes improvements relative to previously published algorithms. The program requires very little operator intervention and provides high analytical throughput. The method is insensitive to drifts in the microscope beam current and by virtue of its speed, less demanding on long term accelerating voltage stability. Results on a variety of samples indicate that the no-standards technique can provide good accuracy. (20 refs.)

Microdefects in X-ray radiation detectors .... See Entry 70748

10.00 THE PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

(for cosmic rays, see 94.40; for high energy-experimental techniques and instrumentation, see 29.)

11.00 GENERAL THEORY OF FIELDS AND PARTICLES

(see also 03.65 Quantum mechanics, 03.70 Theory of quantized fields, 03.80 General theory of scattering)

11.10 FIELD THEORY

70166 The Schwinger model: a view from the temporal gauge. P.Becher (Phys. Inst., Univ. Wurzburg, Wurzburg, Germany).
Ann. Phys. (USA), vol.146, no.2, p.223-61 (1 April 1983).
The author presents a new operator solution of the Schwinger model, i.e. of massless quantum electrodynamics in 1+1 dimensions in the temporal gauge $A^0=0$. This gauge is well-suited for the treatment of static external charges. The energy functional reflects the immediate onset of pair creation of massless fermions. The author shows that every point charge is screened completely by a Yukawa-like polarisation charge cloud of radius $\sqrt{\pi}/e$, e the coupling constant. (77 refs.)

70167 Microcanonical quantum field theory. A.Strominger (Inst. for Advanced Study, Princeton, NJ, USA).
Ann. Phys. (USA), vol.146, no.2, p.419-57 (1 April 1983).
The author develops a fixed action (microcanonical) formulation of quantum field theory. For the case of ordinary renormalisable field theories, it is shown that the microcanonical is entirely equivalent to the canonical formulation. That is, for some particular fixed value of the total action, the Green's functions of the microcanonical theory are equal, in the bulk limit, to those of the canonical theory. The microcanonical perturbation expansion is developed in some detail for $\lambda\phi^4$. The particular value of the action for which the two formulations are equivalent can be calculated to all orders in perturbation theory. The author proves, using Lehmann's Theorem, that this value is one-half Planck unit per degree of freedom, if fermionic degrees of freedom are counted negatively. The one exception to this is supersymmetric theories, where a microcanonical formulation exists if and only if supersymmetry is broken. Finally, it is argued that a microcanonical formulation of quantum gravity may be less pathological than the usual canonical formulation. The relation between the total action and the temperature $\hbar$ is calculated to all orders using the gravitational Schwinger-Dyson equations. (16 refs.)

70168 N=1 superspace formulation of N=2 and N=4 super-Yang-Mills models with central charge. B.Milewski (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.172-88 (9 May 1983).
The component models of $N=2$ and $N=4$ supersymmetric Yang-Mills theories of Sohnius, Stelle and West (1980) are reformulated in terms of $N=1$ superfields. The nonsupersymmetric constraints are supersymmetrized generalizing the linear multiplet in the presence of the nonAbelian gauge superfield and (in the $N=4$ case) a doublet of chiral superfields. The extended supersymmetry transformations preventing constraints are explicitly given in terms of $N=1$ superfields. The authors are able to introduce the constraints back into the Lagrangian using superfield Lagrange multipliers. The on-shell equivalence of this formulation with the formulation of Fayet (1979) with one (for $N=2$) and three (for $N=4$) chiral superfields is shown. The Abelian $N=2$ model is worked out to show the connection between full superspace treatment and the $N=1$ superfield formulation. (11 refs.)

70169 The N=4 supersymmetric E_8 gauge theory and coset space dimensional reduction. D.Olive (Blackett Lab., Imperial Coll., London, England), P.West.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.248-84 (9 May 1983).
Reasons are given to suggest that the $N=4$ supersymmetric E_8 gauge theory be considered as a serious candidate for a physical theory. The symmetries of this theory are broken by a scheme based on coset space dimensional reduction. The resulting theory possesses four conventional generations of low-mass fermions together with their mirror particles. (50 refs.)

70170 The quantum kinks of two-dimensional theories of the ϕ^4 type. E.C.Marino (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.413-29 (23 May 1983).
The author applies a recently established method of kink quantization, to two-dimensional theories of the ϕ^4 type possessing either a $Z(4)\times O(N)$ or an $SU(N)$ symmetry and containing N complex scalar fields. Correlation functions of kinks are estimated through a $1/N$ expansion. Quantum kinks are interpolated by a local field, whenever a broken symmetry phase occurs. These kinks are massless. This result holds up to all orders in $1/N$. (15 refs.)

70171 Superspace, dimensional reduction, and stochastic quantization. B.McClain, A.Niemi, C.Taylor, L.C.R.Wijewardhana (Dept. of Phys., MIT, Cambridge, MA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.430-60 (23 May 1983).
The equivalence between a 6-dimensional stochastic classical scalar field theory and the corresponding 4-dimensional quantum field theory has been shown to stem from a hidden supersymmetry of the former. This has led to a formulation of quantum field theory in a superspace of 6 commuting and 2 anticommuting dimensions. The authors study gauge and spinor field theories defined on this superspace, showing that the dimensional reduction is a consequence of the geometry of the superspace, and that the stochastic formalism for gauge theories is a natural consequence of the structure of the superspace theory. This allows us to extend the stochastic formalism to include spinors. (15 refs.)

70172 Detection of master fields near factorization. J.Carlson, M.B.Halpern (Dept. of Phys., Univ. of California, Berkeley, CA, USA), J.Greensite, T.Sterling.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.461-4 (23 May 1983).
In reduced models the authors verify numerically the onset of factorization (N^{-1} fluctuations), and the forming up of master fields in that regime. (7 refs.)

70173 From N=1 to N=4 extended supersymmetric Yang-Mills fields in a covariant Wess-Zumino gauge. R.Flume (Phys. Inst., Univ. Bonn, Bonn, Germany).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.531-43 (23 May 1983).
It is assumed that $N=1$ supersymmetric Yang-Mills fields coupled to chiral matter fields can be renormalized in a covariant Wess-Zumino gauge with a minimal number of subtractions so that the Ward identities of supersymmetry, ordinary gauge invariance and matter-field-flavour symmetries are satisfied. The chiral Yukawa couplings are supposed to remain unrenormalized. It is shown that on the basis of these assumptions an $N=4$ extended manifestly O(4) invariant theory can be constructed with finite Yukawa and ϕ^4 couplings. A consequence of these nonrenormalizations is the vanishing of the renormalization group β function. (11 refs.)

70174 How well do Monte Carlo simulations distinguish between U(1) and SU(2)? A study of the string tension in U(1) lattice gauge theory. D.G.Caldi (Werner-Heisenberg-Inst. fur Phys., Max-Planck-Inst. fur Phys. und Astrophys., Munchen, Germany).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.48-60 (16 May 1983).
To investigate how a system with a known deconfining phase transition behaves when studied on finite lattices via Monte Carlo simulations, the author has made such studies of compact U(1) lattice gauge theory for 8^4, 10^4, and 12^4 lattices. The author has concentrated on the mean plaquette energy and the string tension. The string tension does not vanish on a finite lattice, but using finite size scaling arguments the indications are that it does vanish on an infinite lattice, where the author predicts the critical coupling $\beta_c=1.008$ and the correlation length exponent $\nu={}^1/_3$. The author compares these results to those for SU(2) and finds that although there are differences, they are not yet definitive. (20 refs.)

70175 A Monte Carlo study of the Gross-Neveu model. Y.Cohen, S.Elitzur, E.Rabinovici (Racah Inst. of Phys., Hebrew Univ., Jerusalem, Israel).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.102-18 (16 May 1983).
Several lattice versions of the Gross-Neveu model are constructed and studied using Monte Carlo methods. The expected chiral structures are confirmed by the numerical results. The correct asymptotic freedom behaviour is recovered with the appropriate number of species taken into account. The models differ in their number of soft modes and their strong coupling behaviour. In some of them, chiral symmetry is restored at a finite coupling. The large-N finite-temperature transition is also found in good agreement with the theoretical value. (11 refs.)

70176 Mass spectra of new particles. Hu Ning (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China).
Commun. Theor. Phys. (China), vol.1, no.1, p.59-67 (1982).
When $\psi(4030)$ is considered as a molecule formed from D^* and $\bar{D}^*$ and not as an excited state of J/ψ, then all excited states of J/ψ may be described by a wave equation of simple harmonic oscillator, with eigenvalues equal to the

squared masses of these states. The same conclusion is also obtained for Υ particles. (2 refs.)

70177 New nonlinear σ models on symmetric spaces. Chou Kuang-chao (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China), Song Xing-chang.
Commun. Theor. Phys. (China), vol.1, no.1, p.69-75 (1982).
Finally two new nonlinear σ models, defined on the symmetric coset spaces $GL(n,c) \otimes GL(n,c)/GL(n,c)$ and $GL(n,c)/U(n)$ respectively. The latter may be useful in discussing the four-dimensional Yang-Mills fields. (5 refs.)

70178 Exotic gauge potential representations and ghost counting via orthosympletic BRS supersymmetry. R.Delbourgo, P.D.Jarvis (Dept. of Phys., Univ. of Tasmania, Sandy Bay, Tasmania, Australia).
J. Phys. A (GB), vol.16, no.8, p.L275-8 (1 June 1983).
Generalised gauge fields and their accompanying ghosts are naturally accommodated in representations of an orthosymplectic supergroup. Counting rules are given for arbitrary irreducible tensors of $OSp(n/m)$, and the connection with representations of the transverse orthogonal group $O(n\text{-}m)$ for 'massless' states is pointed out. (18 refs.)

70179 Angular-momentum operators for dyons. D.S.Bhakuni, O.P.S.Negi, B.S.Rajput (Dept. of Phys., Kumaun Univ., Naini Tal, India).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.15, p.499-502 (9 April 1983).
The study of gauge invariant and rotationally symmetric angular-momentum operators of dyons has been undertaken and the corresponding properties of their eigenvalues have been analysed. It has been shown that the presence of magnetic charge on dyons gives rise to a residual angular momentum and chirality-dependent multiplicity in the eigenvalues of the third component of the angular-momentum operator. (9 refs.)

70180 Main field and symmetric-hyperbolic form of the Dirac equation. A.Strumia (Istituto di Mathematica Applicata, Univ. di Bologna, Bologna, Italy).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.18, p.609-13 (30 April 1983).
A method to obtain a symmetric-hyperbolic system of conservative equations starting from a complex system of conservation laws and their complex conjugate with one supplementary real conservative equation is proposed when a suitable condition equivalent to convexity is fulfilled. It is shown that the Dirac equation fulfils the predicted condition and can be written in symmetric-hyperbolic form. (14 refs.)

70181 Evaporation, annihilation and strong decays of long-lived quarkonia as finite-to-null and null-to-finite temperature processes. S.Iwao (Dept. of Phys., Coll. of Liberal Arts, Kanazawa Univ., Kanazawa, Japan).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.1, p.21-7 (7 May 1983).
Particle evaporation from nuclei, $\bar{p}p$ stop in annihilation, heavy quarkonium and glueball decays have been investigated in the framework of Green's function approach. The author presents ideas for understanding the long life-time of the $\bar{p}$-nucleus system and the so-called Okubo, Zweig and Iizuka rule for the heavy-quarkonium decay. (20 refs.)

70182 The fine-structure constant, magnetic monopoles and Dirac charge quantization condition. T.Datta (Phys. & Astron. Dept., Univ. of South Carolina, Columbia, SC, USA).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.51-4 (14 May 1983).
The authors discuss the implications of the Dirac quantisation condition on the nature and stability of magnetic monopoles. One of the most interesting results is that such a particle has a classical radius larger than its quantum (Compton) or 'atomic' (Bohr) radius. No other elementary particle shows this property. This indicates that the monopoles and inherently relativistic. Atom-like stable bound states of oppositely charged monopoles are unphysical and a pair of primordial monopoles are prone to annihilation, which may explain the so-called monopole paradox. Conversely, if the value of the Sommerfeld fine-structure constant were greater than unity, then 'magnetic-monopole atoms' would have been stable and 'electric atoms' unstable. It appears that in a physical universe for a given value of the fine-structure constant only one kind of sources or charges (either electric or magnetic) are permissible. This is a quite general requirement imposed by the laws of electrodynamics, quantum mechanics and relativity acting simultaneously in conjunction to each other. (11 refs.)

70183 Critical-voltage law for chiral particle production near a monopole. Y.Srivastava, A.Widom (Lab. Nazionali di Frascati, Istituto Nazionale di Fisica Nucleare, Frascati, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.77-80 (14 May 1983).
Recent progress in understanding the implications of winding-number transitions and topological quantized magnetic flux in terms of a sine-Gordon theory in charge space, is here discussed in terms of a previously derived critical-voltage law for such processes in superconducting rings. In particular, chiral particle production in the neighbourhood of a monopole will be of interest. (11 refs.)

70184 The dynamical differential forms of the Klein-Gordon field. R.Arens (Dept. of Math., Univ. of California, Los Angeles, CA, USA).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.117-19 (March 1983).
The author classifies the conserved currents for the Klein-Gordon field. It is shown that there are many which are not associated with invariances of the Lagrangian. (3 refs.)

70185 Particle creation with finite energy density. T.Dray, J.Renn, D.Salisbury (Freie Univ. Berlin, Berlin, Germany).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.145-53 (March 1983).
The authors consider the semiclassical quantization of the Klein-Gordon field on a Robertson-Walker background with a flat-out region. They show that the requirement that the energy density of created particles be finite selects a preferred equivalence class of particle definitions. They present a representative element of the equivalence class so determined. They briefly discuss the generalization to Bianchi *I* spacetimes, and the case of an external Maxwell field. (8 refs.)

70186 Reduction and quantization for singular momentum mappings. J.Sniatycki (Dept. of Math. & Statistics, Univ. of Calgary, Calgary, Alberta, Canada), A.Weinstein.
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.155-61 (March 1983).
When a Hamiltonian action of Lie group on a symplectic manifold has a singular momentum mapping, the reduced manifold may not exist. Nevertheless, one may always construct a Poisson alebra which corresponds to the functions on the reduced manifold in the regular case. The ideas of geometric quantization are extended to Poisson algebras, and it is shown in an example that quantization may be carried out before or after reduction, with isomorphic results. (12 refs.)

70187 Type-*D* solution of sourceless Yang-Mills equations. M.Carmeli, Kh.Huleihil (Center for Theoretical Phys., Ben Gurion Univ. of the Negev, Beer Sheva, Israel).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.245-57 (1 April 1983).
A solution of the classical sourceless Yang-Mills field equations, using the null-tetrad method, is presented. The solution, which includes only the magnetic part, is of type D_p in Carmeli's classification, class *A* in Castillejo-Kugler-Roskie's (1979) classification scheme, and case 3_b in that of Wang-Yang (1978). (12 refs.)

70188 Gel'fand-Yaglom wave equations based on the representation $(^1/_2, {}^5/_2) \oplus (-^1/_2, {}^5/_2) \oplus (^1/_2, {}^3/_2) \oplus (-^1/_2, {}^3/_2) \oplus (^1/_2, {}^3/_2) \oplus (-^1/_2, {}^3/_2)$. C.G.Koutroulos (Dept. of Theoretical Phys., Univ. of St. Andrews, St. Andrews, Fife, Scotland).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.277-301 (1 April 1983).
The charge associated with the Gel'fand-Yaglom wave equation based on the 20-dimensional representation $(^1/_2, {}^5/_2) \oplus (-^1/_2, {}^5/_2) \oplus (^1/_2, {}^3/_2) \oplus (-^1/_2, {}^3/_2) \oplus (^1/_2, {}^3/_2) \oplus (-^1/_2, {}^3/_2)$ is studied according to the definition, of Gel'fand and Yaglom. (6 refs.)

70189 A note on non-Noether constants of motion. M.Crampin (Faculty of Math., Open Univ., Milton Keynes, England).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.209-12 (2 May 1983).
It is shown that various recent results on the existence of constants of motion not arising directly from Noether's theorem or similar considerations, such as the result of Hojman and Harleston (see J. Math Phys., vol.22, p.1414, 1981) for systems with alternative lagrangian formulations, are consequences of some rather simple and general facts of differential geometry. (18 refs.)

70190 Analytic regularization and supersymmetric Ward-Takahashi identities. S.Kumar, Y.Fuji (Inst. of Phys., Univ. of Tokyo, Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.653-63 (Feb. 1983).
Supersymmetric Ward-Takahashi identities of the massless Wess-Zumino model are investigated by means of analytic regularization method. At the one-loop level the identities are satisfied by two- and three-point functions for all values of the regularizing parameter. At the two-loop level, the identity relating the three-point functions is satisfied, while the authors find a violation in the finite parts of the identity connecting the two-point functions if minimal subtraction is used to renormalize the theory. It is observed that this identity is restored if one employs a finite renormalization in addition to the minimal one. A calculation of the two-loop renormalization group function β is also presented. (16 refs.)

70191 Remarks on a stochastic quantization of scalar fields. J.R.Klauder (Bell Labs., Murray Hill, NJ, USA), H.Ezawa.
Prog. Theor. Phys. (Japan), vol.69, no.2, p.664-73 (Feb. 1983).
The Langevin equation approach to derive (non)equilibrium-distribution correlating functions for scalar fields is examined. Regularization introduced by the auxiliary time renders the parameters of the Langevin equation finite in the case of super-renormalizable models while causing no change in the boundary between renormalizability and nonrenormalizability. An heuristic central-limit-type argument is suggested to understand the free-field behavior of nonrenormalizable $(\phi^4)_n$ models, $n>4$. (11 refs.)

70192 Explicit evaluation of anomalies in higher dimensions. P.H.Frampton, T.W.Kephart (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1343-6 (2 May 1983).
The one-loop Kaluza-Klein anomaly is evaluated explicitly for gauge theories in six, eight, and ten dimensions. The result is well defined and unique, despite the nonrenormalizability of the theory. (6 refs.)

70193 Consistency conditions for Kaluza-Klein anomalies. P.H.Frampton, T.W.Kephart (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1347-9 (2 May 1983).
General consistency requirements on anomalies in $D=2n$ dimensions are derived with topological techiques. It is shown that for a non-Abelian gauge theory the group-theoretic piece of the anomaly is an overall multiplicative factor for any even $D \geq 4$. (10 refs.)

70194 Manifestly broken local symmetries at large *N*. W.Celmaster, F.Green (Dept. of Phys., Northeastern Univ., Boston, MA, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1556-9 (16 May 1983).
It is shown how, in the large-N limit of $SU(N)$ gauge theory, a local symmetry can be truly broken. This is illustrated by use of the exact solution of the two-dimensional theory in the presence of a vanishingly small symmetry-breaking source term. The model is also solved at finite N in order to study the approach to $N=\infty$. It is found that any finite-dimensional subgroup of $SU(\infty)$ can be broken. (16 refs.)

70195 Relativistic oscillator: linearly rising trajectories and structure functions. A.O.Barut (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA), H.Beker.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1560-2 (16 May 1983).
A new class of realisations of the dynamical group $O(4, 2)$ depending on an arbitrary function G is found. As a special case it is applied to a moving relativistic composite object which in its rest frame is a three-dimensional oscillator. The wave equation is exactly solved; the generators of the Poincare group are identified. It can be applied to a moving 'bag' or bound state where the constituents are bound by a confining potential. The form factors and structure functions are discussed. (12 refs.)

70196 Topology and supersymmetry breaking in ten-dimensional super-Yang-Mills theory. P.K.Townsend (Lab. de Phys. Theorique, Ecole Normale Superieure, Paris, France).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.180-4 (28 April 1983).
Points out that the vacuum of ten-dimensional super-Yang-Mills theory is characterized by an angle θ, provided that the gauge group is $SU(N)$, $n \geq 5$, $SO(10)$, or E_6. Despite the presence of a massless fermion, θ is a physical parameter because there is no anomalous chiral $U(1)$ symmetry. The author argues that for $\theta \neq 0$ supersymmetry can be spontaneously broken by instanton-like effects. Parity is also broken for general $\theta \neq 0$. (12 refs.)

70197 The reduction of $N=1$ supersymmetric Yang-Mills theory to the light-cone gauge. Y.Hassoun, A.Restuccia, J.G.Taylor (Dept. of Math., King's Coll., London, England).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.197-200 (28 April 1983).
Describes in detail who the non-polynomial $N=1$ super Yang-Mills lagrangian in superfield form can be reduced to the light-cone gauge with only propagating modes. This is achieved by integrating out the inappropriate light-cone projections of the superspace Grassmann variables, leaving a light-cone superspace lagrangian agreeing with that obtained earlier by Taylor (1982). The implications of this for the construction of a covariant superfield version of $N=4$ SYM are discussed briefly. (13 refs.)

70198 Ten-dimensional supersymmetric Yang-Mills theory is not ultraviolet finite on-shell. C.Ragiadakos, J.G.Taylor (Dept. of Maths., King's Coll. London, London, England).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.201-3 (28 April 1983).
The authors find that the one-loop on-shell transition amplitude with four external fermions is not ultraviolet finite in the ten-dimensional supersymmetric Yang-Mills model. (10 refs.)

70199 Discrete chirality and fermion zero modes. S.De Lillo, G.Vitiello (Istituto di Fisica, Univ. di Salerno, Salerno, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.204-8 (28 April 1983).
In a quantum $1+1$ dimensional fermion-soliton system the boson condensation in terms of which the soliton solution can be described affects the fermionic structure behaviour due to the soliton non-trivial topology. The fermion zero-frequency mode is then required in order to recover the broken discrete chirality. (16 refs.)

70200 Anomalies and fermion masses in D dimensions. J.Preskill (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA), P.H.Frampton, H.van Dam.
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.209-11 (28 April 1983).
The authors show that anomalies in D spacetime dimensions are generated by only massless fermions, and note that the manner in which the anomalies of massive fermions cancel is qualitatively different in the two cases $D\equiv2$ and $D\equiv0$ (mod 4). (3 refs.)

70201 On the operator product expansion in the MS-scheme. F.V.Tkachov (Inst. for Nuclear Res., Acad. of Sci., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.212-16 (28 April 1983).
The previously introduced 'extension principle' and R^*-operation are applied to deriving and studying a class of operator product expansions directly in the MS-scheme. Existence of simple explicit formulae for coefficient functions and the phenomenon of 'perfect factorization' are pointed out. (15 refs.)

70202 The algorithm for OPE coefficient functions in the MS scheme. S.G.Gorishny, S.A.Larin, F.V.Tkachov (Inst. for Nuclear Res., Acad. of Sci., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.217-20 (28 April 1983).
Describes a method to derive explicit formulae for coefficient functions of the short-distance operator-product expansion in the MS scheme. (13 refs.)

70203 Reduced large N models as amorphous systems. I.Ya.Aref'eva (Steklov Math. Inst., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.221-4 (28 April 1983).
A vacuum energy for the reduced large N model is estimated by means of the replica method. It is argued that a new phase can appear for the $\phi_D{}^4$ matrix model. This phase is a straightforward analogue of a spin glass phase in disordered spin models. (9 refs.)

70204 Large N limit of two parameter model with arbitrary representation. Fu-Goul Yee (Dept. of Phys., Columbia Univ., New York, NY, USA).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.225-36 (28 April 1983).
The author investigates the $N=\infty$ two parameter model, which consists of a fundamental representation action term and one other irreducible representation action term. This model can be reduced to a pure Wilson action with an effective inverse coupling. Two types of phase diagram are obtained. (14 refs.)

70205 Unconstrained prepotentials in extended superspace. J.Koller (California Inst. of Technol., Pasadena, CA, USA).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.324-8 (5 May 1983).
Presents a deductive method for solving superspace constraints in terms of unconstrained prepotentials which is applicable in extended superspace. The approach is demonstrated in detail for $N=1$ Yang-Mills, and then used to solve the $N=2$ Yang-Mills theory in $d=6$ to all orders. A simple method for writing gauge invariant actions is also given. (7 refs.)

70206 Instability of higher dimensional Yang-Mills systems. S.Randjbar-Daemi (Inst. fur Theoretische Phys., Vienna, Austria), A.Salam, J.Strathdee.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.345-8 (5 May 1983).
The authors investigate the stability of Poincare$\times$O(3) invariant solutions for a pure semi-simple Yang-Mills, as well as Yang-Mills coupled to gravity in 6-dimensional space-time compactified over $M^4\times S^2$. In contrast to the Maxwell U(1) theory in six dimensions coupled with gravity and investigated previously, the present theory exhibits tachyonic excitations and is unstable. (9 refs.)

70207 Compactification of supergravity plus Yang-Mills in ten dimensions. S.Randjbar-Daemi (Inst. fur Theoretische Phys., Vienna, Austria), A.Salam, J.Strathdee.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.349-52 (5 May 1983).
Investigates the criteria which determine supergravity-induced compactification of a supersymmetric Yang-Mills theory in ten dimensions down to spaces of the type (Minkowski)$\times$(G/H). (9 refs.)

70208 A manifestly conformally covariant CP^5 integral formula for massless fields. L.P.Hughston (Lincoln Coll., Oxford, England), T.R.Hurd.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.362-4 (5 May 1983).
The authors formulate a new twistor-type contour integral expression for massless fields which displays manifest conformal covariance. Compact complex Minkowski space is treated as a quadric hypersurface in CP^5. When a point at infinity is chosen to break conformal invariance, the formula can be reduced to the standard twistor contour integral formula due to Penrose (1975). (13 refs.)

70209 Partial color screening by classical Yang-Mills fields. J.E.Mandula (Washington Univ., St. Louis, MO, USA), D.I.Meiron, S.A.Orszag.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.365-8 (5 May 1983).
Non-Coulombic axially (but not spherically) symmetrical static solutions to the classical Yang-Mills equations in the presence of an external point source are numerically found. (21 refs.)

70210 A study of the non-compact non-linear σ model: a search for dynamical realizations of non-compact symmetries. Y.Cohen, E.Rabinovici (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.371-8 (5 May 1983).
The issue of dynamical linear realizations of non-compact symmetries is discussed. The two-dimensional non-compact $O(N,1)/O(N)$ is studied using various approximations. Monte Carlo simulations of the $O(2,1)/O(2)$ non-linear σ model are performed. No significant deviations from the perturbative region are detected. (24 refs.)

70211 The O_3 non-linear σ model in the semi-classical approximation. A.Rouet (Centre de Phys. Theorique, CNRS Luminy, Marseille, France).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.379-82 (5 May 1983).
It is shown that the O_3 nonlinear σ model defined in the semi-classical approximation exhibits a dynamical breaking of the chiral symmetry. The cluster property is satisfied by the isospin invariant observables. (8 refs.)

70212 Topological charge in the lattice Abelian Higgs model. B.Bunk, U.Wolff (Werner-Heisenberg-Inst. fur Phys., Max-Planck-Inst. fur Phys. und Astrophys., Munich, Germany).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.383-6 (5 May 1983).
A lattice version of the two-dimensional Abelian Higgs model is derived with emphasis on preserving the topological charge aspect of the continuum theory. The modulus of the Higgs field is not frozen, and a θ angle exists in the lattice quantum theory. It allows one to observe the topological charge in a Monte Carlo simulation and thus verify the semiclassical dilute vortex gas picture. (4 refs.)

70213 An analytic variational study of the phase structure of compact QED on the lattice. N.D.Hari Dass (CERN, Geneva, Switzerland), P.G.Lauwers, A.Patkos.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.387-93 (5 May 1983).
An analytical variational approach is applied to lattice gauge theories with Jastrow type functionals as ansatze. The results are presented for compact QED in three and four dimensions. (19 refs.)

70214 Quenched lattice gauge models. Zhang Yi-Cheng (SISSA, Trieste, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.394-6 (5 May 1983).
Shows that lattice gauge models can be studied in the complex coupling plane with couplings randomly distributed, its annealed version is the usual mixed action. The author proposes the quenched models and argue that they approach the continuum limit in a smoother way by avoiding first order phase transitions. (10 refs.)

70215 The hyper-Kahler supersymmetric σ-model in six dimensions. G.Sierra, P.K.Townsend (Lab. de Phys. Theorique, Ecole Normale Superieure, Paris, France).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.497-500 (12 May 1983).
The maximally supersymmetric, hyper-Kahler, σ-model is given in six-dimensional superfield form. The hyper-Kahler condition follows from the requirement that the equations of motion be derivable from an action. (8 refs.)

70216 Schwinger-Dyson equations in reduced, quenched, chiral models. F.Green (Dept. of Phys., Northeastern Univ., Boston, MA, USA).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.501-5 (12 May 1983).
It is shown that Schwinger-Dyson equations for the infinite volume U(N) chiral model and the reduced chiral model, quenched according to Parisi's prescription, agree to leading order in N for all values of the coupling and in any number of dimensions d. The conditions under which these equations can determine a theory uniquely are discussed. It is concluded that the two models are equivalent for $d\leq d_c=2$, but not necessarily for $d>d_c$. (15 refs.)

70217 Proper large N limit of the reduced models. Zhang Yi-Cheng (SISSA, Trieste, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.506-8 (12 May 1983).
Two different quenching prescriptions of the large N reduced models are confronted, essential differences are found and they are shown to be inequivalent. (8 refs.)

70218 Excited states and a fermion confinement in a four-Fermi model. P.Furlan (SISSA, Trieste, Italy), R.Raczka.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.527-30 (12 May 1983).
A scalar-pseudoscalar four-Fermi quantum field model for a doublet of fermions is considered. It is shown by a partly nonperturbative analysis that exctied states of collective bosons do exist and form finite approximately linear trajectories $M_n{}^2(I)$. For the same value of model free parameters no bound or excited fermion states do exist: this provides an example of a mechanism for a fermion confinement. However the fermion excited states do exist for selected other values of model parameters. (6 refs.)

70219 A study of actions with next-to-nearest neighbour interactions in four-dimensional Z_2 gauge theory. G.Bhanot, J.-M.Drouffe, A.Schiller, I.O.Stamatescu (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.67-71 (19 May 1983).
By Monte-Carlo simulation, the authors study a mixed action Z_2 theory in four dimensions. The action has terms involving planar 1×1 and 2×1 Wilson loops. They find a rich phase structure for this model, but no second order transitions. An investigation of a theory with bent 2×1 Wilson loops in the action was also done. This also revealed only first order transition. The models they study have interesting frustrated phases with a strong dependence on the choice of boundary conditions. (6 refs.)

70220 Mean-field analysis of the large-N lattice gauge theory: Wilson action versus Eguchi-Kawai action. H.Hasegawa, Sung-Kil Yang (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.72-6 (19 May 1983).
The large-N Wilson lattice gauge theory and the Eguchi-Kawai model are studied by using the method of the mean field with corrections. The large-N Wilson theory undergoes a first order phase transition in agreement with the Monte Carlo data. The equivalence between the Wilson theory and the EK model in the large-N limit breaks down at the one-loop level in the loop expansion in the weak-coupling region due to the symmetry breaking effect. (13 refs.)

70221 One loop corrections to extended operators on the lattice. G.Martinelli (Lab. Nazionali, INFN, Frascati, Italy), Zhang Yi-Cheng.
Phys. Lett. B (Netherlands), vol.125B, no.1, p.77-80 (19 May 1983).
The authors have computed at first order in perturbation theory the general expressions to establish the relation between lattice one site extended fermion operators (used in recent Monte Carlo simulations) and the corresponding operators in the continuum. (6 refs.)

70222 One-loop renormalization in curved spacetimes using the background-field method. M.Omote, S.Ichinose (Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan).
Phys. Rev. D (USA), vol.27, no.10, p.2341-7 (15 May 1983).
The renormalizations of various systems in curved spacetimes are discussed. The one-loop counterterm formula for ultraviolet divergence including fermion fields is obtained. By using them, the authors systematically discuss the renormalizability of the pure Yang-Mills field, quantum electrodynamics, and the Yang-Mills field interacting with fermion fields in general curved spacetimes. (11 refs.)

70223 Twisted-Eguchi-Kawai model: a reduced model for large-N lattice gauge theory. A.Gonzalez-Arroyo, M.Okawa (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2397-411 (15 May 1983).
The authors study the large-N reduced model recently proposed by the present authors (1983). This model is a modified version of the Eguchi-Kawai model incorporating twisted boundary conditions. It is shown that the Schwinger-Dyson equations of this model are the same as in the infinite-lattice theory provided $[U(1)]^4$ symmetry is not spontaneously broken. They study the model at strong coupling, weak coupling, and intermediate coupling using analytical and Monte Carlo techniques. At weak coupling, it is shown that for a particular choice of twist, $[U(1)]^4$ symmetry is not broken and they prove how one recovers usual planar perturbation theory. Monte Carlo data for χ ratios show striking agreement with Wilson-theory results. (34 refs.)

70224 Stochastic quantization of matrix and lattice gauge models. A.Guha, S.-C.Lee (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2412-22 (15 May 1983).
The authors introduce a stochastic diffusion equation and the Fokker-Planck equation for various matrix models including the $U(N)\times U(N)$ chiral model and lattice gauge theories. It is shown how to calculate various $U(N)$ integrals using the stochastic equation. In particular, in the external-field problem, the exact large-N result (in the weak-coupling region) is reproduced and a $1/N^2$ correction is computed. Also, the order parameter $\langle \det U\rangle$ is calculated up to order $1/\beta^2$. In the $U(N)\times U(N)$ chiral model, the large-N reduction and quenching is done in the context of stochastic quantization, and the semiclassical results of Bars, Gunaydin, and Yankielowicz (1982) for the free energy and the two-point correlation function are derived. In lattice gauge theory, a very simple way of deriving the complete Schwinger-Dyson equations from the Fokker-Planck equation is demonstrated and, as in the chiral model, a reduced, quenched stochastic equation is derived. (19 refs.)

70225 Constants of motion for the Liouville field theory. A.Kihlberg (Inst. of Theoretical Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Phys. Rev. D (USA), vol.27, no.10, p.2542-4 (15 May 1983).
Analyzes the general solution of the Liouville equation on periodic two-dimensional spacetime in terms of a set of harmonic oscillators and a 'centre-of-mass motion'. The energy takes a simple form in terms of the associated constants of motion. The obvious Poisson brackets among these latter lead to the correct canonical structure and quantization is discussed. (7 refs.)

70226 Explicit calculation of partition functions for a constant vacuum gauge potential. A.Actor (Dept. of Phys., Pennsylvania State Univ., Fogelsville, PA, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2548-51 (15 May 1983).
The partition function and thermodynamic potential are calculated in arbitrary space-time dimension d for scalar and spinor fields coupled to a constant vacuum gauge potential gA_0 at finite temperature T. For $d=2, 4, 6, \ldots$, closed expressions in terms of Bernoulli polynomials are obtained. This generalizes known results for $d=4$. (15 refs.)

70227 Comments on the non-Abelian Stokes theorem. L.Diosi (Central Res. Inst. for Phys., Budapest, Hungary).
Phys. Rev. D (USA), vol.27, no.10, p.2552-5 (15 May 1983).
Proves the Stokes theorem for non-Abelian gauge fields using general surface coordinates. The result contains both of the known versions of the non-Abelian Stokes theorem and allows one to get a new one which is explicitly invariant under rotations of coordinates. (4 refs.)

70228 Probabilistic interpretation of the dipole ghost models. I.I.Cotaescu (Dept. of Phys., Univ. of Timisoara, Timisoara, Rumania).
Phys. Rev. D (USA), vol.27, no.10, p.2556-8 (15 May 1983).
It is shown that a specific symmetry of the dipole ghost models allows one to derive a good probabilistic interpretation for a particular spin-half model. The arguments given indicate that the interpretation presented holds for any model in which the interaction does not break this symmetry. (6 refs.)

70229 Monte Carlo simulation of SU(2) lattice gauge theory with internal quark loops. V.Azcoiti, A.Nakamura (Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Rome, Italy).
Phys. Rev. D (USA), vol.27, no.10, p.2559-62 (15 May 1983).
Dynamical effects of quark loops in lattice gauge theory with the icosahedral group are studied. The authors employ the standard Wilson action and calculate the fermionic part by a discrete pseudofermionic method. The masses of the π, ρ, and ω are computed and the average value of an effective fermionic action is evaluated. (19 refs.)

70230 Spacelike asymptotic behavior of vacuum expectation values in nonlocal field theory. M.A.Solov'ev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.854-62 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.363-74 (Sept. 1982). [received: May 1983]
A new method is proposed for deriving the cluster decomposition properties of vacuum expectation values in field theories with a mass gap. It is shown that the decomposition property is established with exponential speed for the case of nonlocalizable highly singular fields. The usual Araki-Hepp-Ruelle method (1962) does not apply to such fields. (33 refs.)

70231 Bifurcation of point sources and contour sources of nonlinear fields. O.Sh.Rasizade (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.874-82 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.393-404 (Sept. 1982). [received: May 1983]
The problem of static point sources of a nonlinear scalar field with nonlinearity ϕ^ν (leading term as $|\phi|\to\infty$) in a space of dimension $\gamma\geq 2$ is solved. For $\nu<\nu_c=\gamma/(\gamma-2)$, two different types of point source are found. For $\gamma>2$ when $\nu\geq\nu_c$, there are no point sources. In three-dimensional space, contour sources are possible instead of them. The transition from a distributed sources to a point source when the size of the distributed source tends to zero is also considered. (12 refs.)

70232 Quantum relativistic hydrodynamics of systems with broken symmetry. I. Local-equilibrium state. A.V.Prozorkevich, V.L.Samorodov, S.A.Smolyanskii (Saratov State Univ., Saratov, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.920-6 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.463-72 (Sept. 1982). [received: May 1983]
The nonequilibrium statistical operator method is used to construct a two-velocity relativistic hydrodynamics model of a quantum-field system with broken symmetry and complex scalar order parameter. The approach is based on model expansions of the operators (the energy-momentum tensor, the current density, etc.) used for statistical description of the system in the hydrodynamic stage. These expansions are used to construct the statistical operator and the thermodynamics of a local-equilibrium state. (17 refs.)

70233 Phase transitions and elementary particle physics. M.Creutz (Brookhaven Nat. Lab., Upton, NY, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.1-11
Reviews why particle physicists have recently taken an intense interest in the statistical mechanics of certain lattice models. Phase transitions in these systems are of direct relevance to whether the gauge theory of interacting quarks and gluons can prevent the quark as appearing as a free isolated object. Monte Carlo simulation techniques have given the strongest evidence for the confinement phenomenon and are beginning to make numerical predictions in strong interaction physics. (32 refs.)

70234 Charm production and charm decay in left-right (L-R) symmetric models without 'manifest' L-R symmetry. A.Dutta (Jadavpur Univ., Calcutta, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.34
The suggestion that neutrinos are Majorama fermions with ν_R superheavy is attractive since it enables one to construct L-R symmetric gauge models which can accommodate low mass charged and neutral gauge bosons (W_R and Z_R) in the right handed sector. Consistency with observed K_L-K_S mass difference, however, requires models either (i) with a light W_R but strong departure from 'manifest' L-R symmetry ($\theta_L\neq\theta_R$ $\theta\equiv$Cabibbo-like angle) or (ii) with a very heavy W_R. If one allows mixing between W_L and W_R, the situation $C_R\approx 0$ leads to 'Cabibbo favoured' charm production from valence d quarks in ν-hadron scattering. The above qualitative predictions are discussed quantitatively and results are compared with experimental data. (4 refs.)

70235 Systematic derivation of Prasad-Sommerfield solution. M.Sabir, C.M.Ajithkumar (Dept. of Phys., Univ. of Cochin, Cochin, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.45
The authors give a systematic mathematical derivation of the Prasad-Sommerfield one-monopole solution of the 't Hooft-Polyakov equations. They solve these equations in the Prasad-Sommerfield limit using the bilinear operator method and obtain the Prasad-Sommerfield solution. The application of this method to the general problem away from this limit is also discussed.

70236 Exact, multiple soliton solutions of double sine Gordon field equations. B.V.Baby, K.Babu Joseph (Dept. of Phys., Univ. of Cochin, Cochin, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.46
Exact particular solution of the double sine Gordon field equations are constructed in arbitrary dimensions using the method of base equations. N soliton solutions emerge from an application of the base equation approach. These can represent a single soliton in 1+1 dimensions, when the wave vectors are parallel. In the general case the authors show that the number of solitons is restricted to $N<2q-1$, q being the dimension of spacetime. The solutions are found to be stable and localized under collisions.

70237 Confinement in a Bethe-Salpeter model with logarithmic potential. S.H.Biswas, S.R.Choudhury, K.Datta, A.Goyal (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.47
The covariant Bethe-Salpeter (B-S) equation for two scalar quarks confining through a kernel of the form $K\sim\{(p-p')^2\}^{-3/2}$ does possess a discrete spectrum. The kernel $\{(p-p')^2\}^{-3/2}$ is a simple covariant generalization of the log r potential in the 3-dimensional configuration space. To investigate the spectrum an alternative approximation scheme is used to convert the covariant B-S equation to one in a 3-dimensional space. Consistency of the approximation scheme is checked by applying it to the well known Wick-Cutkosky equation where this technique leads to a Balmer type formula, as expected. The resulting Schrodinger-like equation is studied semi-classically: the relativistic effects depress the energy levels.

70238 Two potential electrodynamics for the particles carrying both the electric and magnetic charges. M.P.Benjwal, D.C.Joshi (Dept. of Phys., Garhwal Univ., Garhwal, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.49
Considering the particles carrying both the electric and magnetic charges, the classical electrodynamics for these particles has been developed in terms of two independent four potentials. Considering the electromagnetic fields produced by electric and magnetic charges respectively under strong time reversal, two types of fields are distinguishable and hence two independent field tensors have to be introduced. The expression for the Lagrangian density, energy momentum tensors and equation of motion have been derived in terms of two independent four potentials.

70239 Interaction of particles carrying both the electric and magnetic charges in predictive relativistic mechanics. S.Kumar, D.C.Joshi (Dept. of Phys., Garhwal Univ., Garhwal, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.50
The interaction between dyons of finite mass has been studied in the framework of Predictive Relativistic Mechanics (PRM) by two independent four potentials. The equation of PRM for such interaction have been solved. Representing the acceleration of the system in terms of a power series expression for the acceleration has been obtained up to the first order.

70240 Generalized fields associated with dyons. D.S.Bhakuni, B.S.Rajput (Dept. of Phys., Kumaun Univ., Naini Tal, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.52
In order to avoid the use of arbitrary string variable studies of reduction, second quantization and interaction of the fields associated with dyons of various spins have been carried out by introducing two four-vector potentials. Assuming the generalized charge generalized four-current and generalized four potential associated with dyons as complex quantities with their real and imaginary parts as electric and magnetic constituents respectively, the authors have derived the generalized field equation and equation of motion for the dyon by choosing a suitable Lagrangian density for generalized electromagnetic fields.

Vector bundle representations of groups in quantum physics ... See Entry 69912
Universal unfolding of Hamiltonian systems: from symplectic structure to fiber bundles .... See Entry 69932
Conservation laws and string-like matter distributions .... See Entry 69952
A relationship between the electrovacuum Ernst equations and nonlinear σ-model .... See Entry 69953
The nonsymmetric-nonabelian Kaluza-Klein theory .... See Entry 69954
Spontaneous symmetry breaking in Kaluza-Klein theories .... See Entry 69956
Gauge theory of gravity .... See Entry 69957
Ten into four won't go .... See Entry 69966
Gauged seven-dimensional supergravity .... See Entry 69967
Aspects of supersymmetric quantum mechanics .... See Entry 70243

A quark model calculation of the weak parity violating asymmetry in high-energy proton-nucleon scattering ....See Entry 70246

Phase structure of variant action lattice gauge theory by mean field theory with corrections ....See Entry 70249

Lie algebras and relativistic wave-equations ....See Entry 70250

Chiral properties of supersymmetric vacua ....See Entry 70258

On dynamical supersymmetry breaking by chiral condensates .See Entry 70260

Cosmological character of the Higgs field ....See Entry 70268

Thoughts on family symmetries ....See Entry 70270

The strangeness-conserving effective weak interaction in the quark basis ....See Entry 70272

Majorana neutrinos and the production of the right-handed charged gauge boson ....See Entry 70276

Monopole topology and the problem of colour ....See Entry 70277

Gauge hierarchy generation and cosmology in locally supersymmetry GUTS ....See Entry 70278

Inverted hierarchy and asymptotic freedom in grand unified supersymmetric theories ....See Entry 70279

The fine-tuning problem in renormalized perturbation theory: spontaneously-broken gauge models ....See Entry 70281

On the calculability of $W_L{}^+$-$W_R{}^+$ gauge mixing ....See Entry 70286

Hydrogen-antihydrogen oscillations in a fractionally charged Pati-Salam model ....See Entry 70293

Three lepton decay of proton in a fractionally charged quark $SU(4)\times SU(2)_L\times SU(2)_R$ model ....See Entry 70295

Gauge fields, BRS symmetry and the Casimir effect ....See Entry 70298

String operator expansion of the T product of two currents near the light cone ....See Entry 70301

A calculation of the electromagnetic vacuum polarization in lattice QCD ....See Entry 70302

Fermion-monopole system reexamined ....See Entry 70303

Massless composite particles and space-time description of gauge transformations ....See Entry 70309

Infra-red solutions of the Schwinger-Dyson equation for the discontinuity of the gluon propagator ....See Entry 70310

A note on the magnetic mass squared in temporal gauge finite temperature QCD ....See Entry 70313

On the colour-singlet quark-glue plasma ....See Entry 70316

Mesons containing a heavy and a light quark in lattice quantum chromodynamics ....See Entry 70319

Short-distance perturbation theory for the leading logarithm models ....See Entry 70328

Vector and scalar confining potentials and the Klein paradox ....See Entry 70355

Confinement in a Bethe-Salpeter model with logarithmic potential ....See Entry 70356

Structure functions of flavoured heavy hadrons in weak semi-leptonic decay ....See Entry 70370

Right-handed current effects in $\Delta S=1$ semileptonic decays ....See Entry 70377

Negative-norm states, superselection rules, and the lepton family ....See Entry 70385

Low temperature expansions in a relativistic mean field approach ....See Entry 70478

Electroweak effects in p-wave superconductors ....See Entry 72538

On the gauge equivalence of the Landau-Lifshitz and the nonlinear Schrodinger equations on symmetric spaces ....See Entry 72573

11.20 S-MATRIX THEORY

70241 Scattering theory for quantum dynamical semigroups. II. R.Alicki, A.Frigerio (Istituto di Sci. Fisiche, Univ. di Milano, Milano, Italy).
Ann. Inst. Henri Poincare Sect. A (France), vol.38, no.2, p.187-97 (1983).
For pt.I see Z. Phys. A, vol.307, p.149-73 (1982). For a class of quantum dynamical semigroups, the authors prove that the scattering matrix on the space of trace class operators exists and can be uniquely decomposed as the sum of an elastic and an inelastic part, which are separately positive. (11 refs.)

70242 A perturbation theory for long-range interactions of the Coulomb type. A.Soffer (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel).
Lett. Math. Phys. (Netherlands), vol.7, no.2, p.163-9 (March 1983).
The modified free Hamiltonian for the Coulomb interaction is used to derive an equation for the *S*-matrix and renormalized asymptotic states. The author obtains an effective potential and the corresponding finite perturbation expansion for the *S*-matrix. The Born approximation is shown to contain a term $(\alpha/p)\delta^3(p-p')$; the (divergent) phase correction which makes the second-order term finite is also explicitly derived. (9 refs.)

High energy scattering theory of many-particle system ....See Entry 69937

On a construction of the *S*-matrix in QED ....See Entry 70299

Topological theory of hadrons. II. Baryons ....See Entry 70358

11.30 SYMMETRY AND CONSERVATION LAWS

(see also 02.20 Group theory)

70243 Aspects of supersymmetric quantum mechanics. F.Cooper, B.Freedman (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Ann. Phys. (USA), vol.146, no.2, p.262-88 (1 April 1983).
The authors review the properties of supersymmetric quantum mechanics for a class of models proposed by Witten (1981). Using both Hamiltonian and path integral formulations, they give general conditions for which supersymmetry is broken (unbroken) by quantum fluctuations. The spectrum of states is discussed, and a virial theorem is derived for the energy. The authors also show that the Euclidean path integral for supersymmetric quantum mechanics is equivalent to a classical stochastic process when the supersymmetry is unbroken ($E_0=0$). By solving a Fokker-Planck equation for the classical probability distribution, they find $P_c(y)$ is identical to $|\Psi_0(y)|^2$ in the quantum theory. (13 refs.)

70244 An $SU(2)\otimes U(1)$ model with massive neutrinos and CP violation in the leptonic sector. C.O.Escobar (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil), V.Pleitez.
Ann. Phys. (USA), vol.146, no.2, p.289-308 (1 April 1983).
The authors examine an $SU(2)\times U(1)$ model incorporating massive neutrinos and CP violation for the leptons. The model has Dirac and Majorana mass terms for the neutrinos and two doublets and one triplet of Higgs bosons. They consider the implications of the model for the neutrino oscillations and for the electric dipole moment of the leptons. (37 refs.)

70245 Time-reversal tests in nuclei. F.Boehm (Dept. of Phys., California Inst. of Technol., Pasadena, CA, USA).
Comments Nucl. & Part. Phys. (GB), vol.11, no.6, p.251-7 (1983).
The author outlines the recent progress in establishing upper limits for the amplitude of T-violating couplings, with respect to weak electromagnetic and strong couplings. (19 refs.)

70246 A quark model calculation of the weak parity violating asymmetry in high-energy proton-nucleon scattering. T.Goldman, D.Preston (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.61-83 (9 May 1983).
The authors perform a quark-model calculation of the parity-violating asymmetry in high-energy polarized proton-unpolarized nucleon scattering. Strong interaction enhancement has been taken into account using both renormalization group techniques and precise one-loop calculations. Essential high-twist (bound state) contributions to the asymmetry have been included. The results indicate large ($\sim 10^{-6}$) positive values for the parity-violating asymmetry at high energy, in agreement with the experimental results of Lockyer et al. (1980). (15 refs.)

70247 Lorentz invariance as a low energy phenomenon. S.Chadha (Rutherford Appleton Lab., Chilton, Didcot, England), H.B.Nielsen.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.125-44 (9 May 1983).
It is proposed that the various symmetries observed in nature be regarded as infrared attractive fixed points of a large class of theories which are not endowed with these symmetries a priori. That this hypothesis is feasible is explicitly demonstrated for the case of Lorentz invariance. The strategy is to consider a suitable noncovariant model of electrodynamics, and to show by calculating the relevant β-functions that this model simulates Lorentz invariance better and better as the energy scale is progressively lowered. (16 refs.)

70248 Supersymmetry at finite temperature. T.E.Clark, S.T.Love (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.349-65 (23 May 1983).
Finite-temperature supersymmetry (SUSY) is characterized by unbroken Ward identities for SUSY variations of ensemble averages of Klein-operator inserted imaginary time-ordered products of fields. Path-integral represenations of these products are defined and the Feynman rules in superspace are given. The finite-temperature no-renormalization theorem is derived. Spontaneously broken SUSY at zero temperature is shown not to be restored at high temperature. (12 refs.)

70249 Phase structure of variant action lattice gauge theory by mean field theory with corrections. J.M.Alberty (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), H.Flyvbjerg, B.Lautrup.
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.61-76 (16 May 1983).
The authors use mean field theory with one-loop corrections to study the phase structure of SU(2) lattice gauge theory with a variant action. In 4d they reproduce the phase diagram found by Bhanot and Creutz (1981) by Monte Carlo methods, including the triple point and the end point of a line of first-order transitions. They predict the phase diagram in 5d with less than 8% error. The role of Z(2) fluxons in the phase transition is elucidated. (25 refs.)

70250 Lie algebras and relativistic wave-equations. C.G.Koutroulos (Dept. of Theoretical Phys., Univ. of St. Andrews, St. Andrews, Scotland).
Fizika (Yugoslavia), vol.15, no.1, p.43-62 (Jan.-March 1983).
Using the methods of Lie algebras the matrices $L_k(k=0,1,2,3)$, appearing in the Bhabha wave-equation on the 16 and 20-dim representations of the group SO (4,1) are given as linear combinations of the basis elements of the Lie algebra B_2. The hermitianizing matrix is also constructed and the masses of the particles determined. Finally the transformation properties of the hermitianizing matrix are studied. (28 refs.)

70251 Some double-valued representations of the linear groups. Y.Ne'eman (Wolfson Chair Extraordinary of Theoretical Phys., Tel Aviv Univ., Tel Aviv, Israel).
Found. Phys. (USA), vol.13, no.4, p.467-80 (April 1983).
The author reviews the mathematical theory of SL(n,R) and its double-covering group $\overline{\text{SL}}$(n,R), especially for n=2, 3, 4. After discussing a variety of physical applications, the author shows that $\overline{\text{SL}}$(3,R) provides holonomic curved space ('world') spinors with an infinite number of components. The author constructs the relevant holonomic 'manifield' and discusses the gravitational interaction of a proton as an example. (41 refs.)

70252 Kronecker products for compact semisimple Lie groups. G.R.E.Black (Phys. Dept., Univ. of Canterbury, Christchurch, New Zealand), R.C.King, B.G.Wybourne.
J. Phys. A (GB), vol.16, no.8, p.1555-89 (1 June 1983).
A review is given of the application of *S*-function techniques to the evaluation of Kronecker products of irreducible representations of compact semisimple Lie groups. Explicit formulae are derived for all irreducible representations of all such groups. Recent developments involving composite Young diagrams are brought to fruition and the vexed problem of SO_{2k} is dealt with completely. New branching rules for the classical groups are given in an appendix. These are exploited in the evaluation of Kronecker products by means of a technique which is applied to both classical and exceptional groups. A discussion is made of various modification rules which are needed to express the final results in standard form. (56 refs.)

70253 Scalar factors for non-canonical subgroup restriction of unitary group. R.S.Nikam, G.G.Sahasrabudhe, C.R.Sarma (Dept. of Phys., Indian Inst. of Technol., Bombay, India).
J. Phys. A (GB), vol.16, no.8, p.1591-601 (1 June 1983).
A procedure has been outlined for obtaining the scalar factors (reduced Wigner coefficients) of the unitary group $U(nm)\supset U(n)\otimes U(m)$. This has been done at the permutation group level for $S_N\downarrow S_{N'}\otimes S_{N''}$ and the equality between the scalar factors of these two groups has been exploited. It has been shown that the scalar factors can be uniquely expressed in terms of the inner and outer product coupling coefficients of the permutation group. The ambiguity due to multiplicity is resolved at the level of the above coefficients. (17 refs.)

70254 Spatial rotations, electromagnetic gauge transformations and the fine-structure constant. G.Rosen (Dept. of Phys., Drexel Univ., Philadelphia, PA, USA).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.48-50 (14 May 1983).
The fine-structure constant may signify an underlying relationship between the associated groups for spatial rotations SO_3 and electromagnetic gauge transformations SO_2. The author considers the Haar-induced volumes of the four- and ten-dimensional envelopments $\epsilon(SO_3{*}SO_2)$ and $\epsilon[(SO_3)^3{*}SO_2]$, and determines the theoretical value of the fine-structure constant required. (2 refs.)

70255 Supersymmetry at finite temperature revisited. M.B.Paranjape (Dept. of Phys., MIT, Cambridge, MA, USA), A.Taormina, L.C.R.Wijewardhana.
Phys. Rev. Lett. (USA), vol.50, no.18, p.1350-3 (2 May 1983).
The authors have formulated supersymmetry at finite temperature, generalizing the recent observations by Van Hove. They find that in a two-dimensional model broken supersymmetry is not restored at high temperature. (9 refs.)

70256 Sypersymmetric phase transition. P.N.Pandita (Dept. of Phys., North-Eastern Hill Univ., Shillong, India), S.Singh.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1550-2 (16 May 1983).
The existence of a second-order phase transition associated with spontaneous supersymmetry breaking in a prototype globally supersymmetric model with a conserved fermion number is demonstrated. The model is solved exactly and it is shown that one of the superfields develops a vacuum expectation value below a critical temperature and that the ground-state energy is nonzero. (11 refs.)

70257 General results on the low energy effective theory for $N=1$ local supersymmetry. R.Gatto (Dept. de Phys. Theorique, Univ. de Geneve, Geneva, Switzerland), G.Sartori.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.333-6 (5 May 1983).
Examines the structure of the recent supersymmetric $N=1$ models in which supersymmetry is spontaneously broken through a gravitational superhiggs effect leading to soft supersymmetry breaking in the low energy effective theory. Under the additional assumption of scale invariance for the low energy superpotential the authors find a general class of negative energy extrema (parallel solutions) which correspond to extrema of the modulus of the superpotential on a unit sphere. Such solutions allow for characteristic scalars at mass values independent of the superpotential, reflecting original dilation and U(1) invariances. Other massive scalars have masses related to the gauge boson masses. (3 refs.)

70258 Chiral properties of supersymmetric vacua. G.Veneziano (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.357-61 (5 May 1983).
Arguments suggesting that chirality is (at least partly) unbroken in a class of gauge theories with exact or softly broken supersymmetry hint at the possible relevance of such theories for constructing composite models of quarks and leptons. (15 refs.)

70259 Fermi-Bose symmetry and Kahler fields. I.M.Benn, R.W.Tucker (Dept. of Phys., Univ. of Lancaster, Lancaster, England).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.47-8 (19 May 1983).
The authors formulate a supersymmetric model in terms of Kahler fields, and comment on the nature of the symmetry viewed in this perspective. (14 refs.)

70260 On dynamical supersymmetry breaking by chiral condensates. U.Ellwanger (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.54-8 (19 May 1983).
The renormalization of Green functions of composite chiral superfields is investigated. The author shows that the solution of the renormalization group equation for the corresponding generating functional does not allow for supersymmetry breaking vacuum expectation values. (15 refs.)

70261 A geometric hierarchy for the supersymmetry-breaking scale. C.Oakley (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England), G.G.Ross.
Phys. Lett. B (Netherlands), vol.125B, no.1, p.59-62 (19 May 1983).
The authors consider F type supersymmetry breaking through O'Raifeartaigh-Fayet potentials. It is shown how a class of models gives rise to a supersymmetry breaking scale reduced relative to the fundamental scale M of the potential by powers of (M/M_{Planck}). The role of R invariance in such potentials is discussed. (12 refs.)

70262 Invisible axions in supersymmetric SU(N). P.H.Frampton (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA), T.Matsuki, W.W.Wada.
Phys. Rev. D (USA), vol.27, no.9, p.2204-10 (1 May 1983).
The strong *CP* problem and the possible Peccei-Quinn symmetry is discussed in a 'natural' supersymmetric SU(N) for N=5, 6, 7, 8 and 9. The authors also show that the R symmetry cannot be the Peccei-Quinn U(1) symmetry. (26 refs.)

70263 Extended supersymmetry in five dimensions with central charges. J.Lukierski (Dept. de Phys. Theorique, Univ. de Geneve, Geneve, Switzerland), L.Rytel.
Phys. Rev. D (USA), vol.27, no.10, p.2354-8 (15 May 1983).
The extended $D=5$ super-Poincare algebra with $4N$ complex spinorial charges and maximal number of $2N^2\text{-}N$ central charges is introduced. The generators of central charges are obtained by the contraction of $SU(2,2;2N)$ superalgebras. The possible reductions of internal-symmetry $Sp(n)\equiv U(n;H)$ due to the presence of central charges are given. The additional $2N^2\text{-}N$ bosonic degrees of freedom defining $D=5$ extended superspace are introduced. (18 refs.)

70264 Effective-potential study of symmetry breaking in scalarless SU(2)×U(1). K.T.Mahanthappa, J.Randa (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2500-30 (15 May 1983).
The authors derive the effective potential as a functional of composite operators for massless, scalarless SU(2)×U(1); and they obtain conditions under which this effective potential is the vacuum energy density for the case of composite operators which are nonlocal in time. General considerations of the number of Goldstone bosons prevent the construction of a realistic model, but they are able to study dynamical symmetry breaking for various unrealistic spectra of physical particles. They first use the standard linearized approximation (LA) to solve the equations obtained for the propagators from the effective potential, and we compare these results to the most-attractive-channel hypothesis. These LA solutions reproduce the standard vector-boson mixing and in addition yield a (reasonable) relation between the vector masses and those of the fermions. However, the linearized equations are also satisfied by the symmetric (massless) solution. In order to determine which solution corresponds to the true vacuum, they use the effective potential in a variational calculation. The linearized-approximation solutions are used to determine the functional forms of the propagators, and the physical masses are treated as variational parameters in minimizing the effective potential. In an Abelian approximation, in which the effects of the vector self-couplings are absent, the mass relations of the LA survive the inclusion of nonlinear effects. On the other hand, if a Hartree-Fock approximation is used for the vector self-couplings, all the desirable features of the LA are lost: The breaking is no longer $I={}^1/_2$, and the relation between vector and fermion masses requires fermions much heavier than the vectors (or very large numbers of lighter fermions). In either approximation, whether spontaneous symmetry breaking occurs depends on the number and quantum numbers of the fermions. Significance of the results and possible future directions are discussed. (27 refs.)

70265 Dynamical symmetry breaking in $SU(2)_L{\times}SU(2)_R{\times}U(1)$. J.Randa (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2531-40 (15 May 1983).
Results of weak-coupling approach to dynamical symmetry breaking within $SU(2)_L{\times}SU(2)_R{\times}U(1)$ are presented. The mixing of the neutral vector bosons is wrong, and a simple reason for this failure is given. (11 refs.)

The stochastic method for numerical simulations: higher order corrections .... See Entry 69862

Vector bundle representations of groups in quantum physics ... See Entry 69912

A relationship between the electrovacuum Ernst equations and nonlinear σ-model .... See Entry 69953

Spontaneous symmetry breaking in Kaluza-Klein theories .... See Entry 69956

Gauge theory of gravity .... See Entry 69957

Supergravity generates hierarchies .... See Entry 69961

Petrov classification of supergravity .... See Entry 69962

Constraints on the stability of mass hierarchies in supergravity .... See Entry 69964

Ten into four won't go .... See Entry 69966

Gauged seven-dimensional supergravity .... See Entry 69967

Supergravity as the messenger of supersymmetry breaking ...... See Entry 69968

Integration over surfaces in superspace .... See Entry 69969

Microcanonical quantum field theory .... See Entry 70167

N=1 superspace formulation of N=2 and N=4 super-Yang-Mills models with central charge .... See Entry 70168

The N=4 supersymmetric E_8 gauge theory and coset space dimensional reduction .... See Entry 70169

The quantum kinks of two-dimensional theories of the ϕ^4 type .... See Entry 70170

Superspace, dimensional reduction, and stochastic quantization .... See Entry 70171

From N=1 to N=4 extended supersymmetric Yang-Mills fields in a covariant Wess-Zumino gauge .... See Entry 70173

How well do Monte Carlo simulations distinguish between U(1) and SU(2)? A study of the string tension in U(1) lattice gauge theory .... See Entry 70174

A Monte Carlo study of the Gross-Neveu model .... See Entry 70175

Exotic gauge potential representations and ghost counting via orthosympletic BRS supersymmetry .... See Entry 70178

Evaporation, annihilation and strong decays of long-lived quarkonia as finite-to-null and null-to-finite temperature processes .... See Entry 70181

Critical-voltage law for chiral particle production near a monopole .... See Entry 70183

Reduction and quantization for singular momentum mappings .... See Entry 70186

Analytic regularization and supersymmetric Ward-Takahashi identities .... See Entry 70190

Explicit evaluation of anomalies in higher dimensions .... See Entry 70192

Consistency conditions for Kaluza-Klein anomalies .... See Entry 70193

Manifestly broken local symmetries at large N .... See Entry 70194

Relativistic oscillator: linearly rising trajectories and structure functions .... See Entry 70195

Topology and supersymmetry breaking in ten-dimensional super-Yang-Mills theory .... See Entry 70196

The reduction of $N=1$ supersymmetric Yang-Mills theory to the light-cone gauge .... See Entry 70197

Ten-dimensional supersymmetric Yang-Mills theory is not ultraviolet finite on-shell .... See Entry 70198

Discrete chirality and fermion zero modes .... See Entry 70199

Unconstrained prepotentials in extended superspace .... See Entry 70205

Compactification of supergravity plus Yang-Mills in ten dimensions .... See Entry 70207

A study of the non-compact non-linear σ model: a search for dynamical realizations of non-compact symmetries .... See Entry 70210

The O_3 non-linear σ model in the semi-classical approximation .... See Entry 70211

The hyper-Kahler supersymmetric σ-model in six dimensions .. See Entry 70215

Schwinger-Dyson equations in reduced, quenched, chiral models .... See Entry 70216

Mean-field analysis of the large-N lattice gauge theory: Wilson action versus Eguchi-Kawai action .... See Entry 70220

Stochastic quantization of matrix and lattice gauge models .... See Entry 70224

Monte Carlo simulation of SU(2) lattice gauge theory with internal quark loops .... See Entry 70229

Quantum relativistic hydrodynamics of systems with broken symmetry. I. Local-equilibrium state .... See Entry 70232

Strong anomaly, spectral-density sum rules, and broken U(3)×U(3) symmetry .... See Entry 70267

Cosmological character of the Higgs field .... See Entry 70268

Thoughts on family symmetries .... See Entry 70270

Searches for rare decays of the muon and for μe conversion as experimental tests of muon number conservation .... See Entry 70271

Do 'tHooft anomaly equations know about Georgi-Glashow grand unification? .... See Entry 70273

Experimental test of baryon conservation: a new limit on neutron-antineutron oscillations in oxygen .... See Entry 70274

Constraint on the photino mass from cosmology .... See Entry 70275

Majorana neutrinos and the production of the right-handed charged gauge boson .... See Entry 70276

Monopole topology and the problem of colour .... See Entry 70277

Gauge hierarchy generation and cosmology in locally supersymmetry GUTS .... See Entry 70278

Inverted hierarchy and asymptotic freedom in grand unified supersymmetric theories .... See Entry 70279

The fine-tuning problem in renormalized perturbation theory: spontaneously-broken gauge models .... See Entry 70281

An inflationary model without fine-tuning or supersymmetry .... See Entry 70283

Light singlet, gauge hierarchy and supergravity .... See Entry 70284

Flavor changing neutral currents and $\Delta S=2$ transitions in the hypercolor scenario .... See Entry 70285

An SU(3) model for electroweak unification .... See Entry 70287

Monopole catalysis of proton decay in SO(10) grand unified models .... See Entry 70288

Hyperleptonic generations in unifying schemes .... See Entry 70289

Supersymmetric grand unified theories and cosmology .... See Entry 70291

A new method for flavor unifications .... See Entry 70292

Hydrogen-antihydrogen oscillations in a fractionally charged Pati-Salam model .... See Entry 70293

Three lepton decay of proton in a fractionally charged quark $SU(4)\times SU(2)_L\times SU(2)_R$ model .... See Entry 70295

Fermion-monopole system reexamined .... See Entry 70303

Glueball formation in chromostatics .... See Entry 70312

On the colour-singlet quark-glue plasma .... See Entry 70316

Mesons containing a heavy and a light quark in lattice quantum chromodynamics .... See Entry 70319

Hadron structure in terms of eight-dimensional space-time manifestation .... See Entry 70326

Properties of the meson system and chiral-symmetry-breaking parameters from quantum chromodynamics .... See Entry 70331

A large mixing effect on η, η' and ι .... See Entry 70333

Decay properties of massless bound gluinos .... See Entry 70335

Thermodynamics of extended hadrons with baryon number .... See Entry 70342

Top-quark mass and bottom-quark decay .... See Entry 70345

Effective potential for $\bar{q}q$-condensation .... See Entry 70346

Updated analysis of the quark-mixing matrix and its phenomenological implications .... See Entry 70351

Fermionic strings with boundary terms. II. The O(2) string .... See Entry 70364

Radiative corrections to neutrino-lepton scattering in the $SU(2)_L\otimes U(1)$ theory .... See Entry 70367

Constraints on light particles from kaon decays .... See Entry 70369

Analysis of radiative pion decay $\pi^-\to e^-\nu\gamma$ .... See Entry 70372

Right-handed current effects in $\Delta S=1$ semileptonic decays .... See Entry 70377

Observable gravitationally induced baryon decay .... See Entry 70378

Proton decay inside the nucleus .... See Entry 70379

Linear symmetric quark theories of baryon magnetic moments .... See Entry 70388

Two-photon decay of 2^+ mesons and $SU(3)_f$ symmetry breaking .... See Entry 70389

Leptoproduction of supersymmetric particles .... See Entry 70392

P-odd effects in the deuteron electrodisintegration $e+d\to e^-+n+p$ .... See Entry 70395

Supersymmetry in two-photon processes .... See Entry 70400

A calculation of $Z^0\to 2$ gluinos .... See Entry 70424

U(6/12) supersymmetries in nuclei .... See Entry 70433

Double beta decay, massive neutrinos and lepton conservation .... See Entry 70493

Double beta decay—an experimental review .... See Entry 70494

Geochemical double beta decay experiments .... See Entry 70495

The Irvine ^{82}Se experiments .... See Entry 70496

Early results from the Battelle-Carolina ^{76}Ge double beta decay project .... See Entry 70497

The status of the UCSB-LBL ^{76}Ge double beta decay experiment .... See Entry 70498

Recent results obtained in the Mt. Blanc experiment on $\beta\beta$ decay of ^{76}Ge .... See Entry 70499

Electroweak effects in p-wave superconductors .... See Entry 72538

Decay of long-lived particles in the early Universe .... See Entry 73985

Inflationary universe with gravity .... See Entry 74195

11.40 CURRENTS AND THEIR PROPERTIES

String operator expansion of the T product of two currents near the light cone .... See Entry 70301

Properties of the meson system and chiral-symmetry-breaking parameters from quantum chromodynamics .... See Entry 70331

Radiative corrections to the leptonic decays of pseudoscalar mesons: contributions of *W* and *Z* mesons .... See Entry 70391

Double beta decay .... See Entry 70504

11.50 DISPERSION RELATIONS AND SUM RULES

70266 The non-perturbative parameter in the SVZ sum rules cannot be $\langle 0|(\alpha_s/\pi)G_{a\mu\nu}G_a^{\mu\nu}|0\rangle$. A.Zalewska, K.Zalewski (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.89-91 (19 May 1983).
New data on the Υ family and the SVZ sum rules are used to evaluate the parameter usually interpreted as $\langle 0|(\alpha_S/\pi)G_{a\mu\nu}G_a^{\mu\nu}|0\rangle$. The results exceeds by almost two orders of magnitude that accepted for the ψ family. This excludes the now standard interpretation. (15 refs.)

70267 Strong anomaly, spectral-density sum rules, and broken $U(3)\times U(3)$ symmetry. S.Debnath (Dept. of Theoretical Phys., Indian Association for the Cultivation of Sci., Calcutta, India), B.Bagchi.
Phys. Rev. D (USA), vol.27, no.9, p.2231-4 (1 May 1983).
The authors obtain, by making use of the anomaly term in the divergence of the flavor-singlet axial-vector-current, new spectral-function sum rules for the pseudoscalar density in a chiral-$SU(3)\times SU(3)\times U_3(1)$ framework. The positivity conditions on the spectral representations of the pseudoscalar densities lead to a new bound on the quark-condensate term $\langle 0|\bar{q}q|0\rangle\leq-(279\text{ MeV})^3$ ($q=u$, d, and s) corresponding to bare-current-quark values of $m_u=m_d\approx 5$ MeV and $m_s\approx 150$ MeV. (11 refs.)

Properties of the meson system and chiral-symmetry-breaking parameters from quantum chromodynamics .... See Entry 70331

QCD charmonium sum rules up to $O(G^4)$ order .... See Entry 70332

Radiative decays of light- and heavy-flavor tensor mesons .... See Entry 70390

Leptoproduction of supersymmetric particles .... See Entry 70392

Soft π^-p and pp elastic scattering in the energy range 30 to 345 GeV .... See Entry 70408

11.60 COMPLEX ANGULAR MOMENTUM; REGGE FORMALISM

(see also 03.80 General theory of scattering, 12.40M in strong interactions)

Possible absorptive corrections in hard-scattering processes at very high energies .... See Entry 70340

Pion-proton backward elastic scattering between 30 and 90 GeV/*c* .... See Entry 70409

12.00 SPECIFIC THEORIES AND INTERACTION MODELS; PARTICLE SYSTEMATICS

12.10 UNIFIED FIELD THEORIES AND MODELS

70268 Cosmological character of the Higgs field. A.Okopinska (Inst. of Phys., Warsaw Univ., Bialystok, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.4, p.235-8 (April 1983).
The Higgs-boson mass in the Weinberg-Salam electroweak theory $M_H=6.6$ GeV is obtained from the experimental limits on the value of the cosmological constant. (10 refs.)

70269 Monopoles underground. J.A.Harvey (Princeton Univ., Princeton, NJ, USA).
AIP Conf. Proc. (USA), no.96, p.299-305 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
A new bound on the product of the galactic flux of monopoles and the cross section for monopole catalyzed nucleon decay, $(F_M/\text{cm}^{-2}\text{ sr}^{-1})$ $(\sigma_{\Delta B}/10^{-27}\text{ cm}^2)\leq 10^{-22}$, and its implications for the detection of monopoles are discussed. (12 refs.)

70270 Thoughts on family symmetries. F.Wilczek (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
AIP Conf. Proc. (USA), no.96, p.313-17 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
Advantages accruing to theories with spontaneous breakdown of flavor symmetries are reviewed. A possible experimental signature in rare K decays is discussed. One particularly attractive breakdown scheme is pointed out. The history of the U(1) problem is briefly discussed, including recent ideas regarding axions. The relevance of Cavendish-type experiments in testing for axions and familons is mentioned. (1 ref.)

70271 Searches for rare decays of the muon and for μe conversion as experimental tests of muon number conservation. D.E.Nagle (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Comments Nucl. & Part. Phys. (GB), vol.11, no.6, p.277-86 (1983).
A brief overview is presented of the present experimental situation regarding sensitive tests of muon-electron number conservation, together with some salient implications. (16 refs.)

70272 The strangeness-conserving effective weak interaction in the quark basis. D.Preston, T.Goldman (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.31-60 (9 May 1983).
Strong interaction corrections to the Glashow-Salam-Weinberg model of electroweak interactions are studied, for the up and down quarks only, to all orders of leading logarithms using renormalization-group techniques. The resulting quark effective weak Hamiltonian is explicitly written out in a form convenient for obtaining matrix elements. The accuracy of this result is estimated by a comparison with finite, one-loop calculations of parity-violating parts of the interaction. (24 refs.)

70273 Do 'tHooft anomaly equations know about Georgi-Glashow grand unification?. A.Davidson, J.Sonnenschein (Dept. of Nuclear Phys., Weizmann Inst. of Sci., Rehovot, Israel).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1339-42 (2 May 1983).
The embedding of $SU(k)_{HC}$ composite schemes within flavor-chiral color-asymptotically-free $SU(N)$ grand unifying theories is examined. It is shown that unless $k=3$, the associated spectator-composite structure conspires to be real under the residual gauge interactions. The exceptional n-preon $SU(3)_{HC}$ scheme is capable of supporting a non-exotic quark/lepton spectrum only if $n=4,5$. The SU(8)-embeddable $n=5$ case leads to a multigenerational Georgi-Glashow SU(5) picture. (17 refs.)

70274 Experimental test of baryon conservation: a new limit on neutron-antineutron oscillations in oxygen. M.L.Cherry, K.Lande, C.K.Lee, R.I.Steinberg (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1354-6 (2 May 1983).
The paper reports the result of a search for baryon-number-nonconserving neutron-antineutron transitions in oxygen using a 300-ton water Cherenkov detector located in the Homestake gold mine at a depth of 4200 meters of water equivalent. The 90%-confidence-level upper limit for the neutron-antineutron oscillations in oxygen, this result corresponds to a lower limit on the free-neutron oscillations time of 2×10^7 sec. (18 refs.)

70275 Constraint on the photino mass from cosmology. H.Goldberg (Dept. of Phys., Northeastern Univ., Boston, MA, USA).

Phys. Rev. Lett. (USA), vol.50, no.19, p.1419-22 (9 May 1983).

A lower bound for the photino mass $m_{\tilde{\gamma}}$ as a function of the spin-0 fermion superpartner mass m_{f} is derived as an extension of the calculation of Lee and Weinberg. The Majorana nature of the photino induces a *p*-wave threshold for annihilation $\tilde{\gamma}\tilde{\gamma}\to f\bar{f}$ into light fermions, and leads to a rather unexpected form for the bound: for 25 GeV $\lesssim m_{\mathrm{f}} \lesssim 45$ GeV, $(m_{\tilde{\gamma}})_{\min} \simeq m_{\tau} = 1.8$ GeV; for $m_{\mathrm{f}} > 45$ GeV, $(m_{\tilde{\gamma}})_{\min}$ increases approximately linearly with m_{f} to a value of 20 GeV when $m_{\mathrm{f}} = 100$ GeV. (17 refs.)

70276 Majorana neutrinos and the production of the right-handed charged gauge boson. W.-Y.Keung, G.Senjanovic (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).

Phys. Rev. Lett. (USA), vol.50, no.19, p.1427-30 (9 May 1983).

A possibility of a very clean signature for the production of ${W_{\mathrm{R}}}^{\pm}$ is pointed out. If the right-handed neutrino is lighter than ${W_{\mathrm{R}}}^{\pm}$, left-right symmetric gauge theory predicts the decay ${W_{\mathrm{R}}}^{+} \to \mu^{+}\mu^{+} + 2$ hadronic jets, with the branching ratio $\simeq 3\%$. The lack of neutrinos in the final state and the absence of a sizable background make ${W_{\mathrm{R}}}^{\pm}$ rather easy to detect (if it exists). Detailed predictions regarding the production and decay rates of ${W_{\mathrm{R}}}^{+}$ are presented. (9 refs.)

70277 Monopole topology and the problem of colour. A.P.Balachandran, G.Marmo, N.Mukunda, J.S.Nilsson, E.C.G.Sudarshan, F.Zaccaria (Dept. of Phys., Univ. of Texas, Austin, TX, USA).

Phys. Rev. Lett. (USA), vol.50, no.20, p.1553-5 (16 May 1983).

Topological obstructions to the definition of unbroken-symmetry transformations in the presence of monopoles with non-Abelian flux are exposed. Consequences for colour and electroweak SU(2) in the context of the SU(5) model are discussed. (10 refs.)

70278 Gauge hierarchy generation and cosmology in locally supersymmetry GUTS. D.V.Nanopoulos, K.A.Olive, M.Srednicki (CERN, Geneva, Switzerland), K.Tamvakis.

Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.171-4 (28 April 1983).

The authors discuss a locally supersymmetric GUT with no unnaturally small couplings and just two input mass scales $M_{\mathrm{P}} \approx 10^{19}$ GeV and $\mu \approx 10^{19}$ GeV. They get out both the weak scale $M_{\mathrm{W}} \approx \mu^{2}/M_{\mathrm{P}}$ and the GUT scale $M_{\mathrm{X}} \approx (\mu M_{\mathrm{P}})^{1/2}$. The model produces an acceptable cosmological scenario similar to the one they have previously discussed for globally supersymmetric GUTs. (32 refs.)

70279 Inverted hierarchy and asymptotic freedom in grand unified supersymmetric theories. H.Aratyn (Phys. Dept., Tech.-Israel Inst. of Technol., Haifa, Israel), M.Moshe.

Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.175-9 (28 April 1983).

The interrelation between an inverted hierarchy mechanism and asymptotic freedom in supersymmetric theories is analyzed in two models for which the authors performed a detailed analysis of the effective potentials and effective couplings. They find it difficult to accommodate an inverted hierarchy together with asymptotic freedom for the matter-Yukawa couplings. (14 refs.)

70280 Unification incorporating observable fractional charge, magnetic monopole and maphon. S.Aoyama (Fachbereich Phys., Gesamthochschule Wuppertal, Wuppertal, Germany), Y.Fujimoto, Zhao Zhiyong.

Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.185-91 (28 April 1983).

The authors discuss the possibility of grand unification which incorporates both observable fractional charge and magnetic monopole under the assumption that there exists an undiscovered exact local U(1) symmetry. (11 refs.)

70281 The fine-tuning problem in renormalized perturbation theory: spontaneously-broken gauge models. O.E.Foda (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).

Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.192-6 (28 April 1983).

Studies the stability of tree-level gauge hierarchies at higher orders in renormalized perturbation theory, in a model with spontaneously-broken gauge symmetries. The author confirms previous results indicating that if the model is renormalized using BPHZ, then the tree-level hierarchy is not upset by the radiative corrections. Consequently, no fine-tuning of the initial parameters is required to maintain it, in contrast to the result obtained using dimensional renormalization. This verifies the conclusion that the need for fine-tuning, when it arises, is an artifact of the application of a certain class of renormalization schemes. (17 refs.)

70282 On the gravitational interaction of a massless spin-5/2 particle. K.Shima (Inst. for Theoretical Phys., Univ. of Karlsruhe, Karlsruhe, Germany).

Phys. Lett. B (Netherlands), vol.124B, no.5, p.321-3 (5 May 1983).

A nonminimal gravitational gauge coupling of massless spin-5/2 particle is studied, where curvatures are constrained but nontrivial. (7 refs.)

70283 An inflationary model without fine-tuning or supersymmetry. M.Sher (Dept. of Phys., Univ. of California, Irvine, CA, USA).

Phys. Lett. B (Netherlands), vol.124B, no.5, p.329-32 (5 May 1983).

An SU_5 model with a fundamental scale *M* and an additional $5+\bar{5}$ of fermions will, for a range of values of the Yukawa coupling, develop a second, deeper asymmetric minimum at a scale $\gg M$ due to radiative corrections. If the latter minimum is 10^{15} GeV, the fundamental scale could be quite small. This potential is discussed in some detail, and it is shown that the transition from the first asymmetric vacuum at $\phi \sim M$ to the second at $\phi \sim 10^{15}$ GeV will be inflationary if $M \lesssim 10^{11}$ GeV. This model will then be an inflationary model with similar phenomenology to Coleman-Weinberg inflation, but without fine-tuning. (20 refs.)

70284 Light singlet, gauge hierarchy and supergravity. A.B.Lahanas (CERN, Geneva, Switzerland).

Phys. Lett. B (Netherlands), vol.124B, no.5, p.341-4 (5 May 1983).

The existence of light singlets to help the breaking of SU(2)×U(1) in supersymmetric grand unified theories destroys the gauge hierarchy. The phenomenon exists for both global and local SUSY-GUT models. (10 refs.)

70285 Flavor changing neutral currents and $\Delta S=2$ transitions in the hypercolor scenario. M.A.B.Beg (Rockefeller Univ., New York, NY, USA).

Phys. Lett. B (Netherlands), vol.124B, no.5, p.403-6 (5 May 1983).

Considers the problem of flavor changing neutral currents (FCNCs) in a hypercolor-based scenario for dynamical symmetry breaking. Within the framework of a simplified model the author focuses on a part of the $\Delta S=2$ amplitudes hitherto considered dangerous, and show that it is subject to a measure of natural suppression, via a GIM-like mechanism herein called pseudo-GIM. Furthermore, this part depends on angles which cannot be determined, directly, from low energy experiments and which may—in the present state of the art—be regarded as adjustable parameters. The FCNC problem, of hypercolor, thus largely reduces to a non-problem. The author also notes that the failure of two groups at PETRA to observe very light pseudoGoldstone bosons is a non-problem as well. Present phenomenology therefore fails to provide any credible evidence that may be used in reaching a verdict on hypercolor; until higher energy machines go into operation one must either reserve judgement or appeal to aesthetic criteria. (7 refs.)

70286 On the calculability of ${\mathrm{W}_{\mathrm{L}}}^{+}$-${\mathrm{W}_{\mathrm{R}}}^{+}$ gauge mixing. G.C.Branco (Dept. de Phys. Theorique, Univ. de Geneve, Geneva, Switzerland), J.-M.Gerard.

Phys. Lett. B (Netherlands), vol.124B, no.5, p.415-20 (5 May 1983).

The authors investigate the conditions which must be satisfied in order for ${\mathrm{W}_{\mathrm{L}}}^{+}$-${\mathrm{W}_{\mathrm{R}}}^{+}$ gauge mixing to be a calculable quantity. In particular a model independent necessary constraint involving fermion mass matrices is derived. (12 refs.)

70287 An SU(3) model for electroweak unification. M.Singer, R.Parthasarathy, K.S.Viswanathan (Dept. of Phys., Simon Fraser Univ., Burnaby, BC, Canada).

Phys. Lett. B (Netherlands), vol.125B, no.1, p.63-6 (19 May 1983).

The authors present a model of electroweak unification based on the group SU(3). They reproduce the standard SU(2)×U(1) effective interactions with $\sin^{2}\theta_{\mathrm{W}} = 1/4$. None of the gauge bosons need acquire a large mass in order to suppress unwanted interactions. (9 refs.)

70288 Monopole catalysis of proton decay in SO(10) grand unified models. S.Dawson, A.N.Schellekens (Fermi Nat. Accelerator Lab., Batavia, IL, USA).

Phys. Rev. D (USA), vol.27, no.9, p.2119-28 (1 May 1983).

The authors construct the monopole spectrum in an SO(10) grand unified theory which has an arbitrary pattern of symmetry breakdown to $\mathrm{SU}(3)\times\mathrm{U}(1)_{\mathrm{EM}}$. They show that if the fermion fields are in a $\underline{16}$ of SO(10), then it is impossible to find an SO(10) theory where monopoles do not catalyze proton decay. Furthermore, the branching ratios for monopole-catalyzed proton decay are identical in SO(10) and SU(5) grand unified theories. The authors also present a criterion for constructing grand unified theories which do not have monopole catalysis of proton decay. (19 refs.)

70289 Hyperleptonic generations in unifying schemes. A.Davidson, J.Sonnenschein (Dept. of Nuclear Phys., Weizmann Inst. of Sci., Rehovot, Israel).

Phys. Rev. D (USA), vol.27, no.9, p.2199-203 (1 May 1983).

It is shown that the requirement of having a fully spectator N_{g}-dimensional generation structure, in the presence of a confining $\mathrm{Su}(n)_{\mathrm{HC}}$ interaction, can be fulfilled in a conventional SU(*N*) grand unified manner only provided $n = N_{\mathrm{g}} = 3$. A possible origin for the exclusive smallness of m_{u}, m_{d}, and m_{s} is then suggested by the global group-theoretical properties of the associated fermionic representation. The price of such a hyperleptonic scenario is briefly discussed. (9 refs.)

70290 Cosmological-type constant derived in a unified field theory. R.T.Hammond (Dept. of Phys. & Astron., Vassar Coll., Poughkeepsie, NY, USA).

Phys. Rev. D (USA), vol.27, no.10, p.2535-7 (15 May 1983).

It is shown that in a unified theory of gravitation and electromagnetism a constant electromagnetic potential contributes to the curvature of spacetime and in so doing acts much like a cosmological constant. (1 ref.)

70291 Supersymmetric grand unified theories and cosmology. G.Lazarides (Rockefeller Univ., New York, NY, USA), Q.Shafi.

Phys. Rev. D (USA), vol.27, no.10, p.2538-41 (15 May 1983).

By examining the behavior of supersymmetric grand unified theories (GUT's) in the very early Universe the authors find two classes of realistic models. In one of them supersymmetry is broken at or near the superheavy GUT scale. The cosmological implications of such models are expected to be similar to those of nonsupersymmetric GUT's. In the second class of models, the superheavy GUT scale is related to the supersymmetry-breaking scale in the manner of Witten (1981). Two types of cosmological scenarios appear possible in this case, either with or without an intermediate (new) inflationary phase. They can be experimentally distinguished, since the former predicts an absence and the latter an observable number density of superheavy monopoles. A mechanism for generating baryon asymmetry in such models is pointed out. (17 refs.)

70292 A new method for flavor unifications. Ngee-Pong Chang (Dept. of Phys., City Coll., City Univ. of New York, New York, NY, USA), Xue Peiyou, Zhou Xianjian.

Sci. Sin. (China), vol.26, no.4, p.412-17 (April 1983).

Chiral symmetry is used to unify flavours in grand unified theories which can deal with real representations of fermions as well as complex representations of fermions. As an example, an *SO*(16) model is constructed which can accommodate four usual generations with left-handed charged weak currents and four generations with right-handed charged weak currents. (9 refs.)

70293 Hydrogen-antihydrogen oscillations in a fractionally charged Pati-Salam model. B.B.Deo, K.Maharana (Dept. of Phys., Utkal Univ., Bhubaneswar, India).

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.30

Choosing the set of antisymmetric sixplet of Higgs mesons in a fractionally charged quark $\mathrm{SU}(4)\times\mathrm{SU}(2)_{\mathrm{L}}\times\mathrm{SU}(2)_{\mathrm{R}}$ gauge model hydrogen-antihydrogen oscillations are analysed. Results turn out to be similar to those obtained by Mahapatra and Sanjanovic with the choice of symmetric Higgs mesons, but neutrinoless double beta decay and muonium-antimuonium transition rates are found to be negligible.

70294 n-n̄ oscillation, H-H̄ oscillation and the double proton decay—are they suppressed by wave function effects?. S.P.Misra, U.Sarkar (Inst. of Phys., Bhubaneswar, India).

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.31

The authors discuss here the substantial corrections arising due to the wave function effects in some standard calculations of matter instability involving n-n̄ oscillation, H-H̄ oscillation and double proton decay. The corrections result from a more fastidious evaluation of the matrix elements and enhance stability of matter against oscillations.

70295 Three lepton decay of proton in a fractionally charged quark $\mathbf{SU(4)\times SU(2)_{L}\times SU(2)_{R}}$ model. B.B.Deo, K.Maharana (Dept. of Phys., Utkal Univ., Bhubaneswar, India).

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.32

An interesting three leptonic decay mode of proton is analysed in a fractionally charged quark $\mathrm{SU}_{\mathrm{C}}(4)\times\mathrm{SU}(2)_{\mathrm{L}}\times\mathrm{SU}(2)_{\mathrm{R}}$ Pati-Salam type of model. With a quark lepton unification mass of about 10^{5} GeV and reasonable values for the colored Higgs mass, the lifetime of proton turns out to be of the order of 10^{31} years.

70296 Double-equivalent photon approximation for processes with massive vector particles. T.Jayaraman, G.Rajasekaran, S.D.Rindani (Dept. of Theoretical Phys., Univ. of Madras, Madras, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.42
The authors show that in the process $e^+e^- \rightarrow e^+e^-\gamma^*\gamma^* \rightarrow e^+e^-V^+V^-$ where V is a massive vector particle with point-like Yang-Mills coupling to the photon, the equivalent-photon approximation is strictly valid only when $|k_1^2||k_2^2| \ll {}^m V^8/M^4$ and $|k_1^2| \ll m_V^2$, $|k_2^2| \ll m_V^2$ (where m_V is the mass of V, M the invariant mass of V^+V^- and k_1 and K_2 the four-momentum of the two virtual photons). They demonstrate the process $e_R^-e_L^+ \rightarrow e_L^+e_L^-W^+W^-$ in the Weinberg-Salam model.

70297 A modification of the equivalent photon approximation for processes with massive vector particles. T.Jayaraman, G.Rajasekaran, S.D.Rindani (Dept. of Theoretical Phys., Univ. of Madras, Madras, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.43
The authors show that in the process $\gamma e \rightarrow \gamma\gamma^* e \rightarrow eV^+V^-$ where V is a massive vector particle (of mass m_V) with pointlike Yang-Mills coupling to the photon, the equivalent-photon approximation is strictly valid only when $|k^2| \ll m_V^2$, k is the four-momentum of the virtual photon γ^*. A new approximation is described where in this constraint on $|k^2|$ can be removed. They demonstrate the method for the process $\gamma e_R^- \rightarrow e_R^-W^+W^-$ in the Weinberg-Salam model.

Unification of generalized electromagnetic and gravitational fields .... See Entry 69958

Supergravity generates hierarchies .... See Entry 69961

Constraints on the stability of mass hierarchies in supergravity .... See Entry 69964

Supergravity as the messenger of supersymmetry breaking ...... See Entry 69968

The N=4 supersymmetric E_8 gauge theory and coset space dimensional reduction .... See Entry 70169

Instability of higher dimensional Yang-Mills systems .... See Entry 70206

An $SU(2)\otimes U(1)$ model with massive neutrinos and CP violation in the leptonic sector .... See Entry 70244

General results on the low energy effective theory for $N=1$ local supersymmetry .... See Entry 70257

Effective-potential study of symmetry breaking in scalarless $SU(2)\times U(1)$ .... See Entry 70264

Dynamical symmetry breaking in $SU(2)_L\times SU(2)_R\times U(1)$ .... See Entry 70265

A survey of W pair production through the two-photon process .... See Entry 70366

Right-handed current effects in $\Delta S=1$ semileptonic decays .... See Entry 70377

Observable gravitationally induced baryon decay .... See Entry 70378

Proton decay inside the nucleus .... See Entry 70379

On $n \rightarrow \bar{p}+e^+ +\nu_e$ .... See Entry 70380

Radiative corrections to the leptonic decays of pseudoscalar mesons: contributions of W and Z mesons .... See Entry 70391

Q^2-, and x_B- and W^2-dependence of hadron multiplicities and the Pati-Salam model .... See Entry 70393

Double beta decay, massive neutrinos and lepton conservation .... See Entry 70493

Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector .... See Entry 70745

Formation of structure in an axion-dominated Universe .... See Entry 74194

Inflationary universe with gravity .... See Entry 74195

12.20 MODELS OF ELECTROMAGNETIC INTERACTIONS

Heavy-ion atomic physics. The decay of the vacuum and intermediate molecules .... See Entry 70581

12.20D Specific calculations and limits of quantum electrodynamics

70298 Gauge fields, BRS symmetry and the Casimir effect. J.Ambjorn, R.J.Hughes (California Inst. of Technol., Pasadena, CA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.336-48 (23 May 1983).
The canonical quantization of the photon field in covariant gauge is studied in the presence of static boundaries, on which the field satisfies either 'bag' or superconductor boundary conditions. The inclusion of the Fadeev-Popov ghost fields is found to be essential for agreement with Coulomb gauge calculations of the Casimir energy. (21 refs.)

70299 On a construction of the *S*-matrix in QED. G.Scharf (Inst. fur Theoretische Phys., Univ. Zurich, Zurich, Switzerland).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.302-24 (1 April 1983).
The construction proceeds in three steps: At first the electron-positron field is quantized in a fixed *C*-number potential *A* (external-field problem). The corresponding *S*-operator is uniquely determined up to a phase depending on *A*. The second step is the construction of this phase by using causality. Finally, the full *S*-matrix is obtained by functional integration over *A*. The steps are carefully done in order to avoid divergences. (12 refs.)

70300 Quasiclassical approach to the high-energy Delbruck scattering. A.I.Mil'shtein, V.M.Strakhovenko (Inst. of Nuclear Phys., Novosibirsk, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.135-8 (25 April 1983).
A quasiclassical approach intended for description of the quantum electrodynamics processes in the Coulomb field at high energies is developed. An expression of the high-energy Delbruck scattering amplitude is derived in a simple form, thereby allowing the authors to define the dependence of the total cross section on the charge of the Coulomb centre. (8 refs.)

70301 String operator expansion of the T product of two currents near the light cone. I.I.Balitsky (Leningrad Nuclear Phys. Inst., Leningrad, USSR).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.230-6 (28 April 1983).
The local operators in the Wilson expansion are shown to group in straight-line string operators. The expansion in string operators enables the author to obtain the twist-four contribution to the T product, which is rather difficult with conventional techniques. The well-known logarithmic corrections to scaling are also obtained from the expansion. (14 refs.)

70302 A calculation of the electromagnetic vacuum polarization in lattice QCD. A.Ali (DESY, Hamburg, Germany), I.Montvay.
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.237-42 (28 April 1983).
The authors present a calculation of the electromagnetic current vacuum polarization in the framework of lattice QCD. A 16th order hopping-parameter expansion of $\langle J_\mu^{em} J_\mu^{em}\rangle_0$ is reported on an 8^4 lattice. It gives a reasonable description of the mass $m_{J/\psi}$ and the electromagnetic current-vector meson coupling constant $f_{J/\psi}$, in the vector meson dominance approximation. (13 refs.)

70303 Fermion-monopole system reexamined. H.Yamagishi (Dept. of Phys., Princeton Univ., Princeton, NJ, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2383-96 (15 May 1983).
The problem of a Dirac particle in a fixed Abelian monopole field is reexamined. The author finds that the boundary conditions adopted by Kazama, Yang, and Goldhaber (1977) can be generalized. When the generalization is made, the author is led to the existence of θ vacua. For massless fermions, chiral symmetry is spontaneously broken. A change in θ is equivalent to a chiral rotation, and the physics is independent of θ. For massive fermions, *CP* invariance is broken except for $\theta=0$, π. The vacuum charge for a unit pole obeys the Witten formula $Q=-e\theta/2\pi$ and the monopole becomes a dyon. The results for the two cases are related by an analog of Levinson's theorem (1949, 1952). The author also notes the connection of these results with fractional quantum numbers on solitons, and with the η invariant of Atiyah, Patodi, and Singer (1973). (55 refs.)

70304 Dual symmetry in classical and quantum spin theory. V.A.Bordovitsyn, S.V.Sorokin (Lenin Komsomol Tomsk Teaching Inst., USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.632-4 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.56-9 (July 1982). [received: May 1983]
Apropos the continuing discussion of the observability of the magnetic charge (the Dirac monopole), there is interest in investigating the dual symmetry of the spin equations of motion in classical and quantum theory. It is known that in dual symmetry theory the presence of a magnetic charge is a simple consequence of the dual invariance of the equations of electrodynamics (Strashev et al. 1975). The matter of the observability of a magnetic charge is not tackled there, and becomes only 'experimentally verifiable'. (11 refs.)

The Schwinger model: a view from the temporal gauge .... See Entry 70166

The fine-structure constant, magnetic monopoles and Dirac charge quantization condition .... See Entry 70182

Type-*D* solution of sourceless Yang-Mills equations .... See Entry 70187

Gel'fand-Yaglom wave equations based on the representation $(^1/_2, {}^5/_2) \oplus (-^1/_2, {}^5/_2) \oplus (^1/_2, {}^3/_2) \oplus (-^1/_2, {}^3/_2) \oplus (^1/_2, {}^3/_2) \oplus (-^1/_2, {}^3/_2)$ .... See Entry 70188

An analytic variational study of the phase structure of compact QED on the lattice .... See Entry 70213

One-loop renormalization in curved spacetimes using the background-field method .... See Entry 70222

Lorentz invariance as a low energy phenomenon .... See Entry 70247

Vector and scalar confining potentials and the Klein paradox .... See Entry 70355

Negative-norm states, superselection rules, and the lepton family .... See Entry 70385

Radiative corrections to Z_0 jet asymmetries in e^+e^- annihilation .... See Entry 70397

12.25 MODELS FOR GRAVITATIONAL INTERACTIONS

(see also 04.60 Quantum theory of gravitation)

Some double-valued representations of the linear groups .... See Entry 70251

On the gravitational interaction of a massless spin-5/2 particle .... See Entry 70282

12.30 MODELS OF WEAK INTERACTIONS

70305 On some tests of the basic properties of the neutral weak interaction. I. With massless neutrinos. G.V.Dass, P.Ram Babu (Dept. of Phys., Indian Inst. of Technol., Bombay, India).
Ann. Phys. (USA), vol.146, no.2, p.395-410 (1 April 1983).
The authors consider the Born approximation scattering, by electrons, of neutrinos (and antineutrinos) of the muon and of the electron types; the general Lagrangian respecting lepton locality is used. Throughout, they study only differential cross sections as the experimental observables. Some tests previously proposed for 'neutrino identity' or Lorentz structure of the neutral weak interaction are reexamined. The existence in $\nu_e e^-$ and $\bar{\nu}_e e^-$ scattering of interference between neutral currents and the (V-A) charged current is investigated with and without μe universality. The threat to lepton locality of lack of enough events for $\bar{\nu}e^-$ or νe^- scattering is also considered. (16 refs.)

70306 On some tests of the basic properties of the neutral weak interaction. II. With massive neutrinos. G.V.Dass, P.Ram Babu (Dept. of Phys., Indian Inst. of Technol., Bombay, India).
Ann. Phys. (USA), vol.146, no.2, p.411-18 (1 April 1983).
For pt.I see ibid., vol.146, no.2, p.395-410 (1983). Assuming a general nonderivative point interaction, and Born approximation, the angular distributions for neutrino scatterings by electrons are written, using only simple considerations, allowing all leptons to have nonzero mass. The distributions have been previously obtained for some special cases, from general considerations by Bell et al. (1975), or in the results of explicit calculations. Applications to the determination of the Lorentz structure of the neutral weak interaction, and to tests of lepton locality are considered. For illustration, two explicit calculations are given; one of these could hold for heavy lepton production, and the other for scattering of very low energy cosmic neutrinos. (10 refs.)

70307 Measurement of the ratios of neutral-current to charged cross sections of neutrino and antineutrino interactions in Ne. P.C.Bosetti, P.Fritze, H.Grassler, F.J.Hasert, R.Schulte, K.Schultze (III. Phys. Inst., Tech. Hochschule Aachen, Aachen, Germany), C.Geich-Gimbel, B.Nellen, R.Pech, B.Wunsch, A.Grant, P.O.Hulth, H.Klein, D.R.O.Morrison, L.Pape, H.Wachsmuth, A.Vayaki, K.W.J.Barnham, R.Beuselinck, E.F.Clayton, D.B.Miller, M.M.Mobayyen, A.Petrides, C.Albajar, G.Myatt, D.Saitta, J.Wells, T.Bolognese, D.Vignaud.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.1-10 (9 May 1983).
The ratios of neutral current to charged current cross sections of neutrino and antineutrino interactions in heavy Ne/H_2 mixture have been measured in

BEBC. The beam was the CERN SPS 200 GeV/*c* narrow band beam. The ratios were obtained using a cut in the transverse momentum of the hadronic system. In the standard Glashow-Salam-Weinberg model. The results correspond to the value of $\sin^2 \theta_w=0.182\pm0.020\pm0.012$. By combining this experiment with data from a hydrogen target the coupling constants $u_L{}^2$ and $d_L{}^2$ are found to be 0.15 ± 0.04 and 0.19 ± 0.05 respectively. (13 refs.)

70308 Decay of weak vector bosons in the broken colour gauge theory with integer charge quarks. S.Lakshmi Bala, G.Rajasekaran, S.D.Rindani.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.38
The processes W→gg and Z→gg are studied to order G_F in the cross-section in the integer-charge quark model. The contributions from these to the processes W→q$\bar{\text{q}}$ and Z→q$\bar{\text{q}}$ and the angular distribution of the two jets are obtained with both unpolarised and polarised initial beams.

Effective-potential study of symmetry breaking in scalarless SU(2)×U(1) ....See Entry 70264

Dynamical symmetry breaking in $\mathrm{SU(2)_L\times SU(2)_R\times U(1)}$ ....See Entry 70265

Flavor changing neutral currents and $\Delta S=2$ transitions in the hypercolor scenario ....See Entry 70285

Double-equivalent photon approximation for processes with massive vector particles ....See Entry 70296

A modification of the equivalent photon approximation for processes with massive vector particles ....See Entry 70297

12.35 COMPOSITE MODELS OF PARTICLES

70309 Massless composite particles and space-time description of gauge transformations. D.Han (Systems & Appl. Sci. Corp., Riverdale, MD, USA), Y.S.Kim, D.Son.
Phys. Rev. D (USA), vol.27, no.10, p.2348-53 (15 May 1983).
Space-time symmetries for massless composite particles are studied within the kinematical framework of the relativistic harmonic-oscillator formalism. It is noted first that the Lorentz-invariant harmonic-oscillator equation is separable in the Kalnins-Miller coordinate system in which the helicity and gauge transformation parameters can be separated from other space-time variables. It is shown that this separation procedure leads to the representations of the Poincare group which display the same space-time symmetry as those for photons and gravitons. The gauge transformation parameters are shown to be internal space-time parameters in the case of massless composite particles. It is shown in particular that the spin in this case is associated with an orbitlike motion on the plane perpendicular to the momentum of the composite particle. (23 refs.)

12.35C General properties of quantum chromodynamics (dynamics, confinement, etc.)

70310 Infra-red solutions of the Schwinger-Dyson equation for the discontinuity of the gluon propagator. F.Paccanoni (Istituto di Fisica, Univ. di Padova, Padova, Italy).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.267-76 (1 April 1983).
The possibility that solutions of the Schwinger-Dyson equation for the gluon propagator increase at large distances is investigated in the gauge technique. Without any assumption on the fourth-gluon vertex function, the author finds that solutions with this property do not exist, if the interacting gluon propagator has the same spin structure as that of the free one. The author sets up an integral equation for the discontinuity of the propagator, with its complete kinematical structure, and shows that a stronger infra-red singularity is possible in this case. (18 refs.)

70311 A flux tube model for hadrons. N.Isgur, J.Paton (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.247-51 (28 April 1983).
The authors have constructed a potential model for hadrons based on the strong coupling flux tube limit of QCD. The model, with quark and string-like degrees of freedom, offers a simple and unified framework in which not only ordinary mesons and baryons but also multiquark states, hermaphrodites, and pure glue states can be discussed. They comment on the relation of this model to the two-body $\mathbf{F}_i.\mathbf{F}_j$ potential model for pure quark states. They also present the expected quantum numbers and estimated masses of the low-lying hermaphrodite and pure glue states. (8 refs.)

70312 Glueball formation in chromostatics. K.A.Milton, W.Wilcox (Dept. of Phys., Oklahoma State Univ., Stillwater, OK, USA).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.252-6 (28 April 1983).
Confinement and bag formation is demonstrated for SU(2) static gluons in a semi-classical model in which the leading logarithm improvement to the classical lagrangian is employed. The gluons are represented by static sources in the adjoint representation and the fields are expanded in the algebra generated by the gluon charges. Restriction is made to the singlet representation by use of a suitable projection operator. The resulting action is equivalent to that of the quark-antiquark except for normalization of the current. This means the gluon and quark string tensions, respectively, are related by $\kappa_A/\kappa_F=1.63$. (16 refs.)

70313 A note on the magnetic mass squared in temporal gauge finite temperature QCD. S.P.Li, M.Baker (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.397-9 (5 May 1983).
Reexamines a recent calculation of the magnetic mass m_{mag} in the temporal gauge and shows that there is not necessarily a g^3T^2 term in $m_{\mathrm{mag}}{}^2$. (6 refs.)

70314 The next term in the thermodynamic potential of QCD. T.Toimela (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.407-9 (5 May 1983).
The thermodynamic potential of QCD is discussed. It is found that the plasmon effect contains besides the g^3-term a contribution of order $g^4\ln g$ at any non-zero temperature. This contribution is connected with the term proportional to $|k|T$ in $\Pi_{00}(k_0=0,\bar{k})$, which term is shown to be independent of the gauge-parameter in the general covariant gauge. (10 refs.)

70315 The SVZ method: why it works and why it fails. B.Durand, J.B.Whitenton (Phys. Dept., Univ. of Wisconsin-Madison, Madison, WI, USA), L.Durand.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.410-14 (5 May 1983).
The authors show in the context of potential theory, first, why the SVZ procedure (1979) for calculating hadronic masses succeeds phenomenologically: it provides a semiclassical interpolating formula which correctly relates input masses to output masses; and second, why it fails theoretically: the potential (or QCD) parameters derived from fits to masses are necessarily different from the true parameters. (16 refs.)

70316 On the colour-singlet quark-glue plasma. H.-Th.Elze, W.Greiner, J.Rafelski (Inst. fur Theoretische Phys., J.W. Goethe-Univ., Frankfurt am Main, Germany).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.515-19 (12 May 1983).
The assumed color-singlet character of physical states is treated exactly in a canonical partition function for the quark-glue plasma in a finite volume. It is shown that this non-peturbative effect leads to a gradual 'freezing' of internal degrees of freedom as compared to the Stephan-Boltzmann limit. (8 refs.)

70317 The limit $m_q \to 0$ of perturbative QCD. F.V.Tkachov (Inst. for Nuclear Res., Acad. of Sci., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.85-8 (19 May 1983).
The effect of light quark masses, as seen from short distances, is discussed. The large logs of m_q/μ are shown to simulate 'vacuum condensates'. (13 refs.)

70318 Alternate factorization for the Drell-Yan process. G.Date (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2076-100 (1 May 1983).
An alternate and more general form of factorization for the Drell-Yan process is derived in perturbation theory. Corresponding generalized anomalous dimensions are defined. Simple calculations verify Mueller's conjecture (1982) for the recovery of improved parton-model results at very high energies. The approach offers a general framework to analyze the role played by soft partons, and to study their influence on asymptotic behavior. (14 refs.)

70319 Mesons containing a heavy and a light quark in lattice quantum chromodynamics. H.W.Hamber (Inst. for Advanced Study, Princeton, NJ, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2239-42 (1 May 1983).
The masses and decay constants of mesons composed of a heavy and a light quark are estimated in the SU(3) lattice gauge theory by a numerical simulation which excludes the effects of dynamic-fermion loops. In a mass region corresponding to the charmed *D* mesons the author finds some evidence for a different ordering of the *P*-wave states compared to the equal-quark-mass case. An accurate determination of the mass of these states could provide another test of QCD. (17 refs.)

70320 Towards an effective bilocal theory from quantum chromodynamics in a background field. J.A.Magpantay (Internat. Atomic Energy Agency, Trieste, Italy).
Phys. Rev. D (USA), vol.27, no.10, p.2423-32 (15 May 1983).
Using the path integral, the author shows how one can get background gauge-invariant bilocals (to be identified with mesons) from QCD in a nontrivial ground state. The author discusses in this paper mainly the formal manipulations, especially how to deal with the zero modes. (8 refs.)

70321 Suppression of color screening at large *N*. J.Greensite, M.B.Halpern (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2545-7 (15 May 1983).
In large-*N* QCD, deconfinement by color screening is suppressed. The adjoint string tension is twice the fundamental string tension. Consequences for models of confinements are discussed, and a simple model of a confining large-*N* master field is given. (10 refs.)

70322 Doubly-logarithmic asymptotic of the quark scattering amplitude with nonvacuum exchange in the *t*-channel. R.Kirschner, L.N.Lipatov (Leningrad Inst. of Nuclear Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.266-73 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.488-501 (Aug. 1982). [received: May 1983]
Nonlinear differential equations of the Riccati type for the *t*-channel partial waves $f_j(t)$ describing the scattering of quarks on the mass shell are derived by employing the dispersion relations. The derivation applies to high energies $s^{1/2}$ in the region $\alpha_s\ln^2(s/\mu^2)\sim1$, where μ is the infrared cutoff parameter with respect to the transverse momenta of the virtual particles. For colorless channels the solutions are found in explicit form. It is shown that the singularities of partial waves with negative signature are in all cases located to the right of the singularities of partial waves with positive signature, i.e. the negative signature dominates in the asymptotic region $\alpha_s\ln^2(s/\mu^2)\gg1$. (15 refs.)

70323 Quark counting of anomalous dimensions in higher orders of quantum chromodynamics. I.S.Avaliani, V.A.Matveev, L.A.Slepchenko (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.839-43 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.339-45 (Sept. 1982). [received: May 1983]
The influence of the higher approximations of quantum chromodynamics on the asymptotic behavior of the cross sections of inclusive processes with large momentum transfers is studied. It is shown that allowance for the two-loop corrections in the quark distribution and fragmentation functions in the region $|1-x_T|\ll1$ does not affect the universality of the quark counting of anomalous dimensions. (10 refs.)

70324 Exactly solvable model of a phase transition between hadronic and quark-gluon matter. M.I.Gorenshtein, G.M.Zinov'ev, V.K.Petrov, V.P.Shelest (Inst. of Theoretical Phys., Acad. of Sci., Ukrainian SSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.843-54 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.346-62 (Sept. 1982). [received: May 1983]
An exactly solvable model of a phase transition between hadronic and quark-gluon matter is proposed. In the model, the hadronic phase is a gas of bags constructed from point massless constituents. The mass spectrum and volume of these bags is found. Asymptotic expressions are obtained for the thermodynamic functions of the system in the neighborhood of the phase transition point. (11 refs.)

70325 Quark-confining potential and the form factors of pion and kaon. R.S.Kaushal (Dept. of Phys., Univ. of Delhi, Delhi, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.36
Pion and kaon form factors are calculated using the wave functions corresponding to a quark confining potential for the quark(q)-antiquark($\bar{\text{q}}$) system.

70326 Hadron structure in terms of eight-dimensional space-time manifestation. H.C.Chandola, B.S.Rajput (Dept. of Phys., Kumaun Univ., Naini Tal, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.51
In order to adequately discuss the problem of representation of ordinary and extended objects and the structure of hadrons, the authors have proposed a real eight-dimensional space-time formulation. The localization spaces and the internal symmetry spaces for the type of objects have been established. The analysis of the related properties of generalized Lorentz transformations in this scheme is related to the study of a homomorphic group, the elements of

which are associated with the mixing of symmetries of internal symmetry spaces for these objects.

Manifestly broken local symmetries at large *N* ....See Entry 70194

Partial color screening by classical Yang-Mills fields ....See Entry 70209

Phase transitions and elementary particle physics ....See Entry 70233

Confinement in a Bethe-Salpeter model with logarithmic potential ....See Entry 70237

Monopole topology and the problem of colour ....See Entry 70277

Flavor changing neutral currents and $\Delta S=2$ transitions in the hypercolor scenario ....See Entry 70285

A calculation of the electromagnetic vacuum polarization in lattice QCD ....See Entry 70302

Properties of the meson system and chiral-symmetry-breaking parameters from quantum chromodynamics ....See Entry 70331

A large mixing effect on η, η' and ι ....See Entry 70333

The structure of quarks and leptons ....See Entry 70360

Measuring gluon condensation ....See Entry 70382

Time limit for hadronic phase transition in the big bang ....See Entry 74192

12.35E Applications of quantum chromodynamics to particle properties and reactions

70327 Failure of a recently proposed $q\bar{q}$ potential to reproduce heavy quarkonium spectroscopy. M.Suwara (Inst. of Phys. & Nuclear Tech., Cracow, Poland).
Acta Phys. Pol B (Poland), vol.B14, no.4, p.281-5 (April 1983).
Flory (1981) has recently found support for the Shifman, Vainshtein and Zakharov (1979), estimate of *G* (the density of gluon condensate in vacuum) by deriving a q-$\bar{q}$ potential which uses *G* as an input and correctly predicts the string tension. Here the present author shows that Flory's potential gives wrong predictions for energy levels and leptonic widths of quarkonia. Consequently agreement found for the string tension is not conclusive. (7 refs.)

70328 Short-distance perturbation theory for the leading logarithm models. S.L.Adler (Inst. for Advanced Study, Princeton, NJ, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.381-94 (23 May 1983).
The author derives a short-distance perturbation expansion for the static potential of quasi-Abelian quark and antiquark source charges, in the models in which renormalization group radiative corrections are retained in the gauge gluon effective dielectric functional. A natural running coupling parameter ζ for the models is identified, and the scale mass Λ_p appearing in ζ is computed by requiring the vanishing of the $O(\zeta^2)$ term in the perturbation expansions. The models are shown to give unsatisfactory results beyond one-loop order in the short-distance expansion, as a result of the breakdown in the ultraviolet of the assumption that the effective action is a local functional of the field strength. The same argument indicates that the assumption of a local effective action becomes self-consistent in the large-distance limit. The coupling parameter ζ is identified as a running coupling which evolves in field strength, rather than momentum, and which becomes infinite in the large-distance limit. (7 refs.)

70329 Glueballs in the two-step potential model. D.S.Kulshreshtha (Dept. of Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.18, p.619-24 (30 April 1983).
Glueball states are considered as the bound states of massive gluons (states of pure glue field) in a nonrelativistic, analytically solvable (for $l=0$), two-step potential model previously employed to study charmonium and bottonium systems and even the light mesons like π, ρ, K,... etc. The mass spectrum of excited states is predicted as $l=0$ radial excitations. Results are in fairly good agreement with the predictions of lattice gauge theories. The gluon mass turns out to be 853 MeV in close agreement with other predictions and the RMS value of glueball radius is found to be $(\langle r_G^2\rangle)^{1/2}=0.716$ fm. (26 refs.)

70330 Glueballs and a tensor dominance model. S.Minami (Dept. of Phys., Osaka City Univ., Osaka, Japan).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.1, p.1-4 (7 May 1983).
A tensor dominance model for the $q\bar{q}$ meson and the glueball G is suggested, and a possible $q^2\bar{q}^2$-G interaction is also discussed. (7 refs.)

70331 Properties of the meson system and chiral-symmetry-breaking parameters from quantum chromodynamics. S.Narison (LAPP Annecy-le-Vieux, France), N.Paver, D.Treleani.
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.347-63 (1 April 1983).
Some QCD-inspired spectral function sum rules are discussed, in view of the most recent experimental results on scalar and pseudoscalar mesons. Estimates are performed of the weak-decay amplitudes of O^- radial excitations, of the current quark mass ratio m_s/m_d and of the quark vacuum condensate ratio $\langle\bar{\psi}_s\psi_s\rangle/\langle\bar{\psi}_u\psi_u\rangle$. (22 refs.)

70332 QCD charmonium sum rules up to $O(G^4)$ order. S.N.Nikolaev, A.V.Radyushkin (Lab. of Theoretical Phys., JINR, Dubna, USSR).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.243-6 (28 April 1983).
The results are presented for the $O(G^4)$ power correction to QCD charmonium sum rules in the vector channel. It is shown that, under the standard assumptions concerning QCD vacuum structure, the inclusion of the $O(G^4)$ terms radically changes the theoretical curve for the ratio r_n, normally used to analyse the lowest charmonium states within the QCD sum rule approach. (15 refs.)

70333 A large mixing effect on η, η' and ι. E-i.Kawai (Dept. of Phys., Ehime Univ., Matsuyama, Japan).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.262-4 (28 April 1983).
The author quantitatively investigates a possible large mixing effect on $\eta(549)$, $\eta'(958)$ and $\iota(1440)$ in a phenomenological way, taking into account of both SU(3) symmetry breaking and gluon intervention. (6 refs.)

70334 $\psi\psi$ production by quarks, gluons and B mesons. B.Humpert, P.Mery (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.265-70 (28 April 1983).
The authors determine, in the framework of perturbative QCD, the $O(\alpha_s^2)$-$O(\alpha_s^4)$ parton cross sections for $\psi\psi$ production by quarks, gluons and B mesons. The hadronic production characteristics are compared with recent data from π^-N scattering. At present energies, $\psi\psi$ production via B meson decay is negligibly small. At collider energies, B production by ($\bar{q}$b) recombination constitutes, however, a considerable production mode. (15 refs.)

70335 Decay properties of massless bound gluinos. E.Franco (Istituto di Fisica Guglielmo Marconi, Rome, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.271-4 (28 April 1983).
Massless gluinos are confined into R-hadrons, together with gluons and quarks. The author estimates the lifetime of such R-hadrons on the basis of a model previously developed to describe ordinary hadrons. The energy spectrum of the emitted nuino is also derived. Using the known limitations on the parameters of broken supersymmetric models, the lower bound to the lifetime of R-hadrons is derived: $\tau>2.3\times10^{-14}$ (1 GeV/M)^5 s. (13 refs.)

70336 Glueballs multiquark states and the OZI rule. H.J.Lipkin (Dept. of Nuclear Phys., Weizmann Inst. of Sci., Rehovot, Israel).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.509-14 (12 May 1983).
New signatures for detection of non-quarkonium mesons are considered, including $K^+K^+\pi^+\pi^-$ and $K_sK_s\pi^+\pi^+$ decays for states where K^+K^+ and K^+K^{*+} decays are forbidden, and *A*-dependence of S* and δ production on nuclei by kaon beams. Analysis of OZI rule shows that only selection rules forbidding hairpin diagrams are valid and that $\phi\phi$ production by pion beams is not a serious OZI violation indicating presence of glueballs. (26 refs.)

70337 Second order QCD prediction for direct photon production in e^+e^- annihilation. I.Antoniadis, L.Baulieu, R.Lacaze (CENS, Gif-sur-Yvette, France).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.92-8 (19 May 1983).
The authors compute the deep inelastic structure function for the decay of a heavy time-like photon into a quasi real photon and hadrons. They show that the QCD corrections imply important modifications to the parton model prediction in the whole *x* range. It is also found that the next to leading QCD contribution is quite large as compared to the leading one. They finally investigate the relationship between this structure function and its space-like analogue. (17 refs.)

70338 Local charge compensation in the quark-cascade jet-production model. S.P.Misra, B.K.Parida (Inst. of Phys., Bhubaneswar, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.35
The charge correlations and the local charge compensation mechanism in rapidity space for quark jets are analysed in the framework of the quark-cascade jet-production model. The calculated results are compared with those observed experimentally in antineutrino-nucleon processes, and for the short range charge correlations observed in e^+e^- annihilation experiments.

70339 The K-factor in the Drell-Yan process and the test of asymptotic freedom. B.P.Mahapatra (Post-Graduate Dept. of Phys., Sambalpur Univ., Burla, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.44
The deep inelastic lepton scattering and massive lepton pair production data are simultaneously and excellently described without the need for the K-factor in the latter process in a simple quark parton model with only power suppressed correction to scaling. This raises grave doubt regarding the large higher order corrections through the K-factor predicted by asymptotic freedom for the Drell-Yan process.

Strong anomaly, spectral-density sum rules, and broken U(3)×U(3) symmetry ....See Entry 70267

Thoughts on family symmetries ....See Entry 70270

Hyperleptonic generations in unifying schemes ....See Entry 70289

Hydrogen-antihydrogen oscillations in a fractionally charged Pati-Salam model ....See Entry 70293

A flux tube model for hadrons ....See Entry 70311

Glueball formation in chromostatics ....See Entry 70312

ψ and Υ systems in a consistent quark model ....See Entry 70350

Fragmentation functions in high energy ν and $\bar{\nu}$ deuterium interactions ....See Entry 70368

Branching-ratio predictions for the $\iota(1440)$ ....See Entry 70375

Quark-quark interaction and $K\rightarrow2\pi$ decays ....See Entry 70376

Can soft gluon effects be measured in electron-positron annihilation ....See Entry 70398

Effect of weak interactions on e^+e^- annihilation into two jets in the integer charge quark model ....See Entry 70401

e^+e^- annihilation into three jets in the integer-charge quark model ....See Entry 70402

Triggering on high-transverse-momentum jets ....See Entry 70421

Direct photon pair production in hadron collisions as a test of integer-charge quark model ....See Entry 70422

12.35H Phenomenological composite models of particle structure and reactions (partons, bags, etc.)

70340 Possible absorptive corrections in hard-scattering processes at very high energies. N.G.Antoniou, N.D.Tracas (Dept. of Theoretical Phys., Univ. of Athens, Athens, Greece), S.D.P.Vlassopulos.
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.1, p.28-32 (7 May 1983).
Absorptive effects in hard-scattering processes, which can possibly originate from multiparton final-state interactions, give rise to a vanishingly small logarithmic correction to the parton→parton+parton splitting process, if simulated by Regge amplitudes. When this effect is iterated, within the leading logarithmic approximation of quantum chromodynamics, it may be promoted to a small power correction to the structure functions and be observable at very high energies. (7 refs.)

70341 Anticipated $t\bar{t}$ states in the quark-confining two-step potential model. D.S.Kulshreshtha (Internat. Centre for Theoretical Phys., Trieste, Italy).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.258-66 (1 April 1983).
The quark-confining, analytically solvable (for $l=0$), two-step potential model previously employed for charmonium and bottomium is now used to study the mass spectrum, thresholds and decay widths of the anticipated $t\bar{t}$ states as a function of quark mass. (11 refs.)

70342 Thermodynamics of extended hadrons with baryon number. S.A.Bonometto (Istituto di Fisica, Univ. di Padova, Padova, Italy).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.325-40 (1 April 1983).
A model for the hadron phase is discussed in conditions similar to the ones expected to hold, in a cosmological context, near the transition from quark matter into hadron matter. The conserved baryon number *B* is taken into account. Some evidence is found of a possible dependence of the transition temperature on *B*. Such a dependence could be quite relevant if a significant part of the present MW background is originated by population-III objects. This ought to be taken into account when results, obtained by means of Monte Carlo techniques on the lattice for the $B=0$ case, are extrapolated to the $B\neq0$ case. (18 refs.)

70343 Mass number dependence of large transverse momentum production and massive lepton pair production: effects of multi-quark clusters on high energy reactions off nuclear targets. S.Date (Dept. of Phys., Waseda Univ., Tokyo, Japan), A.Nakamura.
Prog. Theor. Phys. (Japan), vol.69, no.2, p.565-78 (Feb. 1983).
Assuming the existence of multi-quark clusters in nucleus the authors investigate large transverse momentum production in hadron-nucleus and alpha-alpha collisions and mass lepton pair production off nuclear targets in the framework of hard scattering model. The probability of finding multi-quark clusters in nucleus is parameterized in a simple form and the modified Kuti-Weisskopf model is employed to determine the parton distributions in the clusters. This approach yields results which are in reasonable accord with the data. It is shown that the existence of the multi-quark clusters in the nucleus is consistent with present data of muon pair experiments. (25 refs.)

70344 Hadron-quark phase transition and statistical quark bag model. S.Kagiyama (Dept. of Phys., Kagoshima Univ., Kagoshima, Japan), S.Hirooka, H.Kikukawa, J.Kikukawa.
Prog. Theor. Phys. (Japan), vol.69, no.2, p.579-88 (Feb. 1983).
The existence of the intermediate phase between hadron and quark phases, i.e., the multi-quark bag phase, is considered. The negative surface energy is introduced phenomenologically on the basis of the statistical quark bag model in order to ensure that the smallest bag is most stable. However, with the increase of the quark number density in the bag, the surface energy becomes unimportant in comparison with the kinetic energy of the quark, and it is well known that the mass of the bag is proportional to 3/4 power of the quark number in the naive bag model. Thus the multi-quark bag becomes stable at high quark density. The above property suggests a possibility of the hadron-multiquark bag phase transition. (36 refs.)

70345 Top-quark mass and bottom-quark decay. P.H.Ginsparg, S.L.Glashow (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA), M.B.Wise.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1415-18 (9 May 1983).
The possibility of a long *B*-meson lifetime is explored, in which case the weak mixing angles θ_2 and θ_3 are quite small. This allows the derivation of a lower bound on the top quark mass as a function of the *B*-meson lifetime, by comparison of the short-distance prediction for the *CP*-nonconservation parameter ϵ with its experimental value. The bound is significant for $\tau_B>4\times10^{-13}$s. (12 refs.)

70346 Effective potential for $\bar{q}q$-condensation. K.Higashijima (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.257-8 (28 April 1983).
A method to evaluate the short distance contribution to an effective potential for $\bar{q}q$-condensation is proposed. Chiral symmetry is shown to break down spontaneously by studying the effective potential in the two-loop approximation. (7 refs.)

70347 Nucleon resonances and the quark model. H.Hogaasen (Dept. of Phys., Univ. of Oslo, Oslo, Norway), J.M.Richard.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.520-2 (12 May 1983).
The authors study the level ordering of the nucleon resonances in the nonrelativistic quark model. With any plausible phenomenological potential, the orbital excitation with negative parity always turns out to have the lowest mass contrary to the experimental situation where the Roper resonance with positive parity comes first. (13 refs.)

70348 On the axial charge and other static properties of the quark core in nucleons. R.Tegen, M.Schedl, W.Weise (Inst. of Theoretical Phys., Univ. of Regensburg, Regensburg, Germany).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.9-13 (19 May 1983).
The authors present calculations of the axial vector constant g_A in models where relativistic quarks are confined by scalar potentials, with special emphasis on center-of-mass corrections and pion cloud effects. It is demonstrated that pionic contributions to g_A from a$f_\pi\partial_\mu\phi$ term in the axial current vanish for finite pion mass. Confining potentials of the form cr^n with $n=2$, 3 give acceptable values for g_A together with quark core radii between 0.5 and 0.6 fm. They also calculate the pion-nucleon coupling constant and establish a connection between g_A and the quark core part of the magnetic moment, including center-of-mass corrections. About half of the proton magnetic moment is shown to come from the quark core. (18 refs.)

70349 Charmed-quark fragmentation into charmed hadrons. L.M.Jones (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), R.Migneron.
Phys. Rev. D (USA), vol.27, no.9, p.2063-7 (1 May 1983).
The authors show that in a model where fragmentation functions are created from jet calculus followed by recombination, the fragmentation function of charmed quarks into *D* mesons will fail to peak at low *x* at currently accessible values of Q^2. Likewise, the fragmentation of a *c* quark into a Λ_c is much less peaked toward small *x* then the production of protons by *u* quarks. The model predicts a magnitude for the fragmentation function much smaller than is experimentally observed. (16 refs.)

70350 ψ and Υ systems in a consistent quark model. C.S.Kalman, N.Mukerji (Elementary Particle Phys. Group, Concordia Univ., Montreal, Quebec, Canada).
Phys. Rev. D (USA), vol.27, no.9, p.2114-18 (1 May 1983).
The η_b, η'_b, *P*, and *D* states of the Υ system as well as the missing $^1P_1$, $^3D_2$, and $^3D_3$ states of the ψ system are calculated based on a parameter system obtained from the known masses of states of the charmonium system. The results are consistent with flavor independence of the potential; however, the compositions of the states are found to differ in the ψ and Υ systems. (11 refs.)

70351 Updated analysis of the quark-mixing matrix and its phenomenological implications. L.-L.Chau, W.-Y.Keung, M.D.Tran (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2145-66 (1 May 1983).
The 3×3 quark-mixing matrix of Kobayashi and Maskawa (1973) is reexamined, using the latest information in calculating the K_L-K_S mass difference and the *CP*-violation parameter ϵ, and using recent data of ν and $\bar{\nu}$ production of opposite-sign dileptons, and semileptonic decays of charmed and *b*-flavored particles; then the neutral-particle-antiparticle mixing and *CP* violation in the $D^0\bar{D}^0$, $B^0\bar{B}^0$, and $T^0\bar{T}^0$ systems are calculated. Constraints on the mixing matrix and *t*-quark mass from $K_L\rightarrow\mu^+\mu^-$ are also considered. (48 refs.)

70352 Gluon-gluon interactions in the bag model. C.E.Carlson (Coll. of William & Mary, Williamsburg, VA, USA), T.H.Hansson, C.Peterson.
Phys. Rev. D (USA), vol.27, no.9, p.2167-81 (1 May 1983).
An effective spin-dependent interaction Hamiltonian for low-lying gluon modes is calculated to $O(\alpha_s)$ in the MIT bag model. The authors give expressions for the energy shifts of low-lying glueballs. (20 refs.)

70353 Bag-inspired gluonic and relativistic effects in a harmonic-oscillator model. A.Sharma, M.Gupta (Dept. of Phys., Panjab Univ., Chandigarh, India).
Phys. Rev. D (USA), vol.27, no.9, p.2182-90 (1 May 1983).
The harmonic-oscillator (HO) quark model, wherein Pauli spinors are replaced by Dirac spinors and quark masses are less than $^1/_3$ of the nucleon mass, is studied in the spirit of the bag model. In particular, the authors have calculated G_A/G_V and the magnetic moment and charge radius of the proton; the variation of these quantities with quark mass and spring constant is also investigated. In the case of the magnetic moment they find that the relativistic correction is of the right order of magnitude, while in the case of charge radius the result is better than the nonrelativistic HO value. For G_A/G_V they find that the relativistic corrections bring the nonrelativistic value of 1.667 down to ~1.50 only; reasons for this less-than-anticipated fall are investigated in detail. Furthermore, the authors have calculated certain gluon probability integrals; the trend of the results is the same as those of Golowich (1978) and of Close and Horgan (1980). (27 refs.)

70354 Recoil corrections in bag models. J.-L.Dethier, R.Goldflam, E.M.Henley, L.Wilets (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2191-8 (1 May 1983).
The recoil corrections to bag models are considered using a definition of the center-of-energy operator analogous to the Newtonian concept of center of mass. This definition is used to calculate corrections to bag energy, charge radius, and other properties within the framework of the soliton bag model. Some of the results also apply directly to the MIT bag model and compare favorably with other analyses. (13 refs.)

70355 Vector and scalar confining potentials and the Klein paradox. P.M.Fishbane (Phys. Dept., Univ. of Virginia, Charlottesville, VA, USA), S.G.Gasiorowicz, D.C.Johannsen, P.Kaus.
Phys. Rev. D (USA), vol.27, no.10, p.2433-8 (15 May 1983).
Confining potentials in equations involving the interaction of fermions lead to no Klein paradoxes if the strength of the vector potential is appropriately limited compared to the scalar potential. For linear potentials the Regge trajectories are asymptotically like those of the harmonic oscillator, namely, $E^2\sim j$. (7 refs.)

70356 Confinement in a Bethe-Salpeter model with logarithmic potential. S.N.Biswas, S.R.Choudhury, K.Datta, A.Goyal (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India).
Phys. Rev. D (USA), vol.27, no.10, p.2439-44 (15 May 1983).
The authors show that the covariant Bethe-Salpeter equation for two scalar quarks confined through a kernel of the form $K\sim[(p-p')^2]^{-3/2}$ possesses a discrete spectrum: this kernel is a simple covariant generalization of the potential in configuration space proportional to $\ln r$. To investigate the spectrum, they adopt a new approximation scheme to convert the covariant Bethe-Salpeter equation into a three-dimensional one, the consistency of the scheme being checked by applying it to the Wick-Cutkosky equation (1954) for the covariant Coulomb problem and obtaining a Balmer-type formula. The spectrum as revealed by investigating the *S*-wave part of the resulting three-dimensional equation by semiclassical methods is essentially of the type obtained from the Schrodinger equation with a $\ln r$ potential; relativistic effects depress the energy levels. (12 refs.)

70357 Topological theory of hadrons. I. Mesons. H.P.Stapp (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2445-77 (15 May 1983).
Spin is incorporated into the hadronic topological expansion scheme. Spin analogs of Chan-Paton factors (1969) are introduced in a way that avoids the troubles encountered in earlier attempts. Those troubles, at the meson level, were, first, the occurrence of twice the wanted number of pseudoscalar and vector mesons; second, the occurrence of parity-doublet partners of the pseudoscalar and vector mesons; and third, the occurrence of these parity-doublet partners as particles of negative metric, called ghosts. These troubles are all avoided by introducing a new topological level, called zero entropy, that lies below the ordered level. At the zero-entropy level quarks of opposite chirality are treated as distinct particles. The theory has been extended to all hadrons, and the basic particles are exactly those of the constituent-quark model, which for baryons start with the (56^+) and (70^-). The theory is formulated in the *M*-function framework, where the 'quarks' are represented by two-component spinors, and it entails $SU(6)_w$ symmetry of the hadronic vertices at a low level of the topological expansion. (31 refs.)

70358 Topological theory of hadrons. II. Baryons. H.P.Stapp (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Rev. D (USA), vol.27, no.10, p.2478-82 (15 May 1983).
For pt.I see ibid., vol.27, p.2445 (1983). The first paper of this series described a method for incorporating spin into the meson sector of the topological theory of hadrons. This second paper extends the theory to all hadrons. It also incorporates into the covariant *S*-matrix topological framework the group-theoretic properties of the constituent-quark model. (18 refs.)

Relativistic oscillator: linearly rising trajectories and structure functions .... See Entry 70195

Excited states and a fermion confinement in a four-Fermi model .... See Entry 70218

One loop corrections to extended operators on the lattice .... See Entry 70221

Monte Carlo simulation of SU(2) lattice gauge theory with internal quark loops .... See Entry 70229

A quark model calculation of the weak parity violating asymmetry in high-energy proton-nucleon scattering .... See Entry 70246

The strangeness-conserving effective weak interaction in the quark basis .... See Entry 70272

String operator expansion of the T product of two currents near the light cone .... See Entry 70301

Decay of weak vector bosons in the broken colour gauge theory with integer charge quarks .... See Entry 70308

Glueball formation in chromostatics .... See Entry 70312

Alternate factorization for the Drell-Yan process .... See Entry 70318

A large mixing effect on η, η' and ι .... See Entry 70333

$\psi\psi$ production by quarks, gluons and B mesons .... See Entry 70334

Decay properties of massless bound gluinos .... See Entry 70335

Second order QCD prediction for direct photon production in e^+e^- annihilation .... See Entry 70337

The K-factor in the Drell-Yan process and the test of asymptotic freedom .... See Entry 70339

Glueball production in the valon-recombination model .... See Entry 70359

On the D^0-D^+ lifetime problem: evaluation of interference and W-exchange effects .... See Entry 70374

Right-handed current effects in $\Delta S=1$ semileptonic decays .... See Entry 70377

Magnetic moments of light baryons in harmonic model .... See Entry 70387

Linear symmetric quark theories of baryon magnetic moments .... See Entry 70388

Leptoproduction of supersymmetric particles .... See Entry 70392

Inclusive electron production in e^+e^- annihilation at 29 GeV .... See Entry 70399

Higgs-boson production in p-$\bar{p}$ collisions at collider energies .. See Entry 70420

The quark model and the nucleon-nucleon interaction .... See Entry 70460

The meson and quark-gluon degrees of freedom in NN-interaction at low and intermediate energies .... See Entry 70461

Nucleon recurrences in the cloudy bag model .... See Entry 70462

Thermodynamics of phase transition expected in HI collision at high energy .... See Entry 70567

Mass spectrum of dilepton produced in relativistic heavy ion collision .... See Entry 70568

12.35K Other composite models
(inc. composite quarks and leptons)

70359 Glueball production in the valon-recombination model. M.S.Zahir (Dept. of Phys., Univ. of Victoria, Victoria, British Columbia, Canada).
Phys. Rev. D (USA), vol.27, no.9, p.2056-62 (1 May 1983).
The author further investigates the internal structure of a valon and determines the gluon distribution in a manner consistent with the analysis of low-p_T reactions. He then proceeds to calculate the possible production of glueballs in the target fragmentation of deep-inelastic νp scattering and discuss how glueball production might influence the rate of 'unfavored' particle productions in the fragmentation of hadrons. (16 refs.)

70360 The structure of quarks and leptons. H.Harari.
Sci. Am. (USA), vol.248, no.4, p.48-60 (April 1983).
They have been considered the elementary particles of matter, but instead they may consist of still smaller entities confined within a volume less than a thousandth the size of a proton. (no refs.)

Chiral properties of supersymmetric vacua .... See Entry 70258

Do 'tHooft anomaly equations know about Georgi-Glashow grand unification? .... See Entry 70273

12.40 MODELS OF STRONG INTERACTIONS

70361 Model hadron asymptotic behaviour. P.A.Kralchevski, A.V.Nikolov (Faculty of Phys., Univ. of Sofia, Sofia, Bulgaria).
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.3-13 (1983).
The authors consider a set of asymptotic equations that describe the model hadron interaction. An iterative procedure consisting of two stages is proposed and the first stage is exhaustively studied. The principle of contracting transformations has been applied for this purpose. Under rather general and natural assumptions, solutions in a series of metric spaces suitable for physical applications have been found. For each of these spaces a solution with unique definiteness is found. (9 refs.)

70362 Solution of Chew-Low equations in the quadratic approximation. V.P.Gerdt, A.Yu.Zharkov (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.868-74 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.384-92 (Sept. 1982). [received: May 1983]
The second-order power contributions are found in the framework of the iterative scheme of construction of the general Chew-Low equation (1956) proposed by Gerdt (1980). In contrast to the linear approximation obtained by Gerdt, the quadratic approximation has an infinite number of poles in the complex plane of the uniformizing variable w. It is shown that allowance for the quadratic corrections in the general solution makes it possible to distinguish the class of solutions possessing the required Born pole at the point w=0. The most cumbersome part of the analytic computations in the present study was done on a computer using the algebraic system REDUCE-2. (13 refs.)

12.40E Statistical models

70363 Strong coupling expansion of the Liouville model. G.A.Aldazabal, E.Dagotto, R.Deza (Inst. Balseiro, Mendoza, Argentina), N.Parga.
Phys. Lett. B (Netherlands), vol.125B, no.1, p.81-4 (19 May 1983).
Using a strong coupling expansion the authors show that in two dimensions the Liouville model has a continuous energy spectrum and that the mean value of the field is infinite. They also apply the technique to the one-dimensional system and to a simple quantum mechanical problem where those properties are known to be true. (12 refs.)

12.40H Duality and dual models

70364 Fermionic strings with boundary terms. II. The O(2) string. P.Di Vecchia (Phys. Dept., Univ. of Wuppertal, Wuppertal, Germany), B.Durhuus, P.Olesen, J.L.Petersen.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.395-412 (23 May 1983).
The authors compute the boundary terms for the O(2) string by use of Polyakov's approach to the quantization problem. The effective action is conformally U(1) invariant, but breaks chiral invariance. (8 refs.)

The electrodynamics with magnetic monopoles. II. Canonical formalism .... See Entry 69902

How well do Monte Carlo simulations distinguish between U(1) and SU(2)? A study of the string tension in U(1) lattice gauge theory .... See Entry 70174

Explicit evaluation of anomalies in higher dimensions .... See Entry 70192

Consistency conditions for Kaluza-Klein anomalies .... See Entry 70193

Failure of a recently proposed $q\bar{q}$ potential to reproduce heavy quarkonium spectroscopy .... See Entry 70327

12.40M Complex angular momentum plane; Regge poles and cuts (Reggeons)
(see also 11.60 for general theory)

Possible absorptive corrections in hard-scattering processes at very high energies .... See Entry 70340

Vector and scalar confining potentials and the Klein paradox .... See Entry 70355

Pion-proton backward elastic scattering between 30 and 90 GeV/c .... See Entry 70409

Analysis of $\pi^-p\rightarrow\pi^0n$ scattering at high energies .... See Entry 70411

12.40P Absorptive, optical, and eikonal models
(for diffraction and diffractive production models, see 12.40S)

Upper limits on beauty meson production in π^-collisions at 280 GeV/c .... See Entry 70418

12.40Q Potential models

A flux tube model for hadrons .... See Entry 70311

The SVZ method: why it works and why it fails .... See Entry 70315

Glueballs in the two-step potential model .... See Entry 70329

Anticipated $t\bar{t}$ states in the quark-confining two-step potential model .... See Entry 70341

Bounds on long-range hadronic interactions .... See Entry 70403

12.40S Multiperipheral and multi-Regge models
(inc. diffraction and diffractive production models)

Soft π^-p and pp elastic scattering in the energy range 30 to 345 GeV .... See Entry 70408

12.40V Vector-meson dominance

A calculation of the electromagnetic vacuum polarization in lattice QCD .... See Entry 70302

Glueballs and a tensor dominance model .... See Entry 70330

12.70 HADRON MASS FORMULAS

Supergravity generates hierarchies .... See Entry 69961

Failure of a recently proposed $q\bar{q}$ potential to reproduce heavy quarkonium spectroscopy .... See Entry 70327

Anticipated $t\bar{t}$ states in the quark-confining two-step potential model .... See Entry 70341

12.90 MISCELLANEOUS THEORETICAL IDEAS AND MODELS

70365 A new technique of looking for the Lagrange functions of massive free particles. M.Yamada (Tech. Junior Coll., Ibaraki Univ., Hitachi, Ibaraki, Japan).
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.135-47 (1982).
A new systematic method is given for obtaining completely general class of the Lagrange functions of massive particles, and it is applied to the cases of spin 2 and of spin 3. (7 refs.)

Elementary particle resonances from a semiclassical perspective .... See Entry 69816

Constraint on Lorentz non-invariance from the Michel parameter .... See Entry 70381

13.00 SPECIFIC REACTIONS AND PHENOMENOLOGY

13.10 WEAK AND ELECTROMAGNETIC INTERACTIONS OF LEPTONS

70366 A survey of W pair production through the two-photon process. M.Katuya (Lab. of Phys., Shizuoka Women's Univ., Shizuoka, Japan).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.421-3 (5 May 1983).
Gives a survey of the total and differential cross sections for the W pair production both via one-photon and via two-photon processes in e^+e^- collisions. (7 refs.)

Double-equivalent photon approximation for processes with massive vector particles .... See Entry 70296

A modification of the equivalent photon approximation for processes with massive vector particles .... See Entry 70297

13.15 NEUTRINO INTERACTIONS
(inc. interactions involving cosmic rays)

70367 Radiative corrections to neutrino-lepton scattering in the $SU(2)_L \otimes U(1)$ theory. S.Sarantakos, A.Sirlin (Dept. of Phys., New York Univ., New York, NY, USA), W.J.Marciano.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.84-116 (9 May 1983).
The radiative corrections of $O(\alpha)$ to the final electron spectrum and the total cross sections for the processes $\nu_\mu+e\rightarrow\nu_\mu+e$, $\bar{\nu}_\mu+e\rightarrow\bar{\nu}_\mu+e$, $\nu_e+e\rightarrow\nu_e+e$, and $\bar{\nu}_e+e\rightarrow\bar{\nu}_e+e$ are studied in the framework of the $SU(2)_L \otimes U(1)$ theory. The electroweak corrections to the first two processes are presented in two equivalent schemes in terms of $(G_\mu, \sin^2\theta_W)$ and $(G_\mu, \sin^2\theta_W(m_W))$. As a byproduct, the relationship to $O(\alpha)$ between the basic parameters $\sin^2\theta_W\equiv1-m_W{}^2/m_Z{}^2$ and $\sin^2\theta_W(m_W)$ (defined by modified minimal subtrac-

tion) is explicitly given. The QED corrections are evaluated in the extreme relativistic (ER) regime of the final electron ($E_e'\gg m_e$) for the situation in which the bremsstrahlung photons are unobserved and unrestricted. The ER approximation allows one to obtain simple analytic expressions for the differential electron spectrum and the total cross sections. The relationship to $O(G_F\alpha)$ between the spin-averaged differential cross sections for the above processes in the ER regime is derived. (24 refs.)

70368 Fragmentation functions in high energy ν and $\bar{\nu}$ deuterium interactions. D.Allasia (Istituto di Fisica, Univ. di Torino, Turin, Italy), C.Angelini, S.Barlag, L.Bertanza, F.Bianchi, A.Bigi, V.Bisi, F.Bobisut, T.Bolognese, E.Calimani, R.Casali, P.Capiluppi, S.Ciampolillo, J.Derkaoui, M.L.Faccini-Turluer, R.Fantechi, V.Flaminio, A.G.Frodesen, D.Gamba, G.Giacomelli, B.Grung, A.Halsteinslid, A.Hornaes, H.Huzita, B.Jongejans, M.Loreti, C.Louedec, G.Mandrioli, A.Marzari-Chiesa, P.Mazzanti, L.Mosca, K.Myklebost, A.Nappi, R.Pazzi, G.M.Pierazzini, L.Riccati, A.Romero, A.M.Rossi, A.Sconza, P.Serra-Lugaresi, G.W.van Apeldoorn, P.van Dam, D.Vignaud, C.Visser, R.Wigmans.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.543-9 (12 May 1983).
Quark fragmentation functions are studied in charged current ν and $\bar{\nu}$ interactions in deuterium. The W^2, Q^2 and y dependences are compared with the predictions of first order QCD and with those of higher twists. The W^2 dependence is a small effect in the authors' kinematical range and their data are well linked to the higher W^2 muon scattering experiment. The Q^2 dependence of nonsinglet fragmentation functions is well reproduced by first order QCD but part of this dependence could be due to some low W kinematical effect. The y-z factorization breaking seems to be a low W effect but a small higher twist term, as predicted by Berger (1980) cannot be excluded. (17 refs.)

On some tests of the basic properties of the neutral weak interaction. I. With massless neutrinos .... See Entry 70305

On some tests of the basic properties of the neutral weak interaction. II. With massive neutrinos .... See Entry 70306

Measurement of the ratios of neutral-current to charged cross sections of neutrino and antineutrino interactions in Ne .... See Entry 70307

Local charge compensation in the quark-cascade jet-production model .... See Entry 70338

Glueball production in the valon-recombination model .... See Entry 70359

Test for a heavy, long-lived neutral boson from $K_{\pi 2}$ decay in neutrino beams .... See Entry 70373

13.20 LEPTONIC AND SEMILEPTONIC DECAYS OF MESONS

70369 Constraints on light particles from kaon decays. J.Ellis, J.S.Hagelin (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.189-214 (9 May 1983).
The authors show that the decay $K^+\to\pi^+$+unobserved neutrals (?) can give useful information about light neutral particles, including the number of neutrino types. Observation of the decay $K^+\to\pi^+ + ?$ would give a lower bound on the number of neutrinos, which would be strengthened by improvement of the present lower bound on the top quark mass m_t. Nonobservation of the decay $K^+\to\pi^+ + ?$ gives an upper bound on the number of neutrinos whose associated leptons have masses outside a window whose width shrinks as m_t increases. Perturbative strong interactions are included in the calculations. They also estimate the rates for $K^+\to\pi^+$+light neutral supersymmetric particles such as photinos, gravitinos and shiggses. They find that decays into photinos and gravitinos are suppressed relative to conventional neutrinos whereas decays into shiggses may be comparable with one conventional neutrino flavour. They stress the desirability of a new round of $K^+\to\pi^+ + ?$ decay experiments. (43 refs.)

70370 Structure functions of flavoured heavy hadrons in weak semi-leptonic decay. S.Iwao (Dept. of Phys., Coll. of Liberal Arts, Kanazawa Univ., Kanazawa, Japan).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.18, p.603-8 (30 April 1983).
To study the properties of the flavoured heavy hadrons, the structure functions for them are introduced in their weak semi-leptonic decays. The scaling hypothesis and the associated properties are investigated through the beauty meson decay. (17 refs.)

70371 Search for massive neutrinos in the decay $\pi\to e\nu$. D.A.Bryman, R.Dubois, T.Numao, B.Olaniyi, A.Olin (TRIUMF, Vancouver, Canada), M.S.Dixit, J.-M.Poutissou, J.A.Macdonald.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1546-9 (16 May 1983).
The positron spectrum from the decay $\pi^+\to e^+\nu_e$ has been examined for evidence of peaks arising from an admixture in the ν_e weak eigenstate of massive neutrinos. Limits on the intensity of such peaks, together with the measured $\pi\to e\nu$ branching ratio, have been used to derive constraints on the neutrino mixing parameters over the range $4\ \text{MeV}<m(\nu)<135\ \text{MeV}$. (16 refs.)

70372 Analysis of radiative pion decay $\pi^-\to e^-\nu\gamma$. Jing-Ning Huang, Ching-Yieh Lee (Dept. of Phys., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2227-30 (1 May 1983).
The authors give a quantitative account of radiative pion decays. By the chiral structure of the interaction and the fact of the low mass ratio between an electron and a pion, one can suppress the inner-bremsstrahlung contribution and correspondingly enhance the structure-dependent contribution by looking at decays with the emission of a negative-helicity electron. By this observation, they examine a way of determining the value of the structure-dependent parameter γ, giving particular attention to the decay spectra with this electron helicity. They also investigate the effects of a neutrino mass in this process. (11 refs.)

Mesons containing a heavy and a light quark in lattice quantum chromodynamics .... See Entry 70319

Failure of a recently proposed $q\bar{q}$ potential to reproduce heavy quarkonium spectroscopy .... See Entry 70327

Anticipated $t\bar{t}$ states in the quark-confining two-step potential model .... See Entry 70341

Top-quark mass and bottom-quark decay .... See Entry 70345

Radiative corrections to the leptonic decays of pseudoscalar mesons: contributions of W and Z mesons .... See Entry 70391

13.25 HADRONIC DECAYS OF MESONS

70373 Test for a heavy, long-lived neutral boson from $K_{\pi 2}$ decay in neutrino beams. S.Barshay (III. Phys. Inst., Tech. Hochschule Aachen, Aachen, Germany).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.259-61 (28 April 1983).
A boson A^0 which couples to a flavor change and emanates from $K^+\to\pi^+A^0$ at a branching level of $\lesssim 10^{-7}$ could decay only via $A^0\to e^{\mp}\mu^{\pm}$ with a lifetime of a few milliseconds. This would give rise to anomalous $(e\mu)$ events at a level which should be detectable in present low-energy neutrino beams. (13 refs.)

70374 On the D^0-D^+ lifetime problem: evaluation of interference and W-exchange effects. H.Sawayanagi, K.Fujii, T.Okazaki, S.Okubo (Dept. of Phys., Hokkaido Univ., Sapporo, Japan).
Phys. Rev. D (USA), vol.27, no.9, p.2107-13 (1 May 1983).
The authors investigate the Cabibbo-allowed nonleptonic decays of the D mesons by using the relativistic quark model combined with the free-quark picture for the final state. Two main ideas which have been proposed to explain the lifetime difference between D^+ and D^0, i.e. the interference model and the W-exchange-dominance model, are considered. One can treat the noninterference and the interference terms on the same footing, and find that the interference effect is not the main origin of the lifetime difference because of the color and spin mismatch. It also seems to be difficult to enhance the W-exchange diagram even if one can vitiate the color and helicity suppression. (16 refs.)

70375 Branching-ratio predictions for the $\iota(1440)$. W.F.Palmer, S.S.Pinsky (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2219-22 (1 May 1983).
A simple pole model is used to predict $\iota\to\delta\pi$, $\rho\gamma$, $\omega\gamma$, $\phi\gamma$, $\rho\pi\pi$, and $\eta\pi\pi$. The rates $\iota\to\eta\pi\pi$ and $\iota\to KK\pi$ are examined in detail. In the pole model the rate $\iota\to\eta\pi\pi$ is compared to $\eta'\to\eta\pi\pi$ and one has the prediction $B(\iota\to\eta\pi\pi)/B(\iota\to KK\pi)=10\%$. A direct calculation that takes into account the cancellation between $\iota\to\delta\pi\to(\eta\pi)\pi$ and $\iota\to\eta\epsilon\to\eta(\pi\pi)$, the $K\bar{K}$ threshold, and SU(3) violations seen in the decay of the δ, predicts $20\%\le B(\iota\to\eta\pi\pi)/B(\iota\to KK\pi)\le 110\%$. Both calculations are consistent with the experimental limit of 50%. (16 refs.)

70376 Quark-quark interaction and $K\to 2\pi$ decays. C.P.Singh (Dept. of Phys., VSSD Coll., Kanpur India), P.K.Chatley.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.37
The authors investigate $K\to 2\pi$ decays using some effective phenomenological one-gluon exchange interaction potentials in which the relativistic corrections are small and the spin dependent force is essentially of long range.

Thoughts on family symmetries .... See Entry 70270

Mesons containing a heavy and a light quark in lattice quantum chromodynamics .... See Entry 70319

$\psi\psi$ production by quarks, gluons and B mesons .... See Entry 70334

Glueballs multiquark states and the OZI rule .... See Entry 70336

Anticipated $t\bar{t}$ states in the quark-confining two-step potential model .... See Entry 70341

Top-quark mass and bottom-quark decay .... See Entry 70345

13.30 DECAYS OF BARYONS

70377 Right-handed current effects in $\Delta S=1$ semileptonic decays. T.Oka (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1423-6 (9 May 1983).
Some problems encountered in describing the $\Delta S=1$ semileptonic hyperon decays in terms of the Cabibbo model are considered, and these decays are studied in the $SU(2)_L \otimes SU(2)_R \otimes U(1)$ gauge theory. It is found that a reported discrepancy between the Cabibbo model and experiment in $\Lambda\to pe\bar{\nu}_e$ can be accounted for if right-handed currents exist. The only obstacle to this interpretation is the experimental sign of the electron asymmetry in $\Sigma\to ne\bar{\nu}_e$ which, as in the Cabibbo model, is predicted to be negative. (29 refs.)

70378 Observable gravitationally induced baryon decay. J.Ellis, J.S.Hagelin (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA), D.V.Nanopoulos, K.Tamvakis.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.484-90 (12 May 1983).
The authors find that in supersymmetric theories gravitodynamic effects scaled by the inverse of the Planck mass can induce baryon decay at an observable rate. In a minimal supersymmetric (susy) grand unified theory (GUT) the dominant gravitationally induced baryon decay mode is $B\to\bar{\nu}+K$, with a likely admixture of $p\to(e^+ \text{ or } \mu^+)+K$. As a by-product, they present an improved estimate of Higgs-mediated baryon decay branching ratios in minimal susy GUTs. They consider the possibility that a loss of quantum coherence may be observable in gravitationally induced baryon decay, but argue that this would be difficult to reconcile with successful experimental test of quantum mechanics. (23 refs.)

70379 Proton decay inside the nucleus. M.V.N.Murthy, K.V.L.Sarma (Tata Inst. of Fundamental Res., Bombay, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.29
The authors study the effects of nuclear environment on the baryon-number-violating decays inside a nucleus. In decays of the type $p\to\pi^0e^+$ that calculate the effects due to Fermi motion of the decaying nucleon on the distributions of the final positron momentum (k) and of the 'back-to-back' angle (θ) between π^0 and e^+. Absorptive decays such as $pp\to pe^+$ with virtual π^0 and ω^0 exchanges have been studied incorporating the two-nucleon correlations in the initial state. Calculations are specialized to two-body decays but do not depend on any specific GUT model.

70380 On $n\to\bar{p}+e^++\nu_e$. V.Gupta, V.Singh (Tata Inst. of Fundamental Res., Bombay, India), S.Pakvasa.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.33
Estimates for the rate of $\Delta B=2$ decay mode $n\to\bar{p}e^+\nu_e$ are discussed. It is suggested that experimental setups to study proton decay and n-$\bar{n}$ oscillations can provide limits on this mode.

Monopoles underground .... See Entry 70269

Three lepton decay of proton in a fractionally charged quark $SU(4)\times SU(2)_L\times SU(2)_R$ model .... See Entry 70295

Inclusive production of the charmed baryon Λ_c^+ in nCH-interactions near 55 GeV .... See Entry 70413

13.35 DECAYS OF LEPTONS

70381 Constraint on Lorentz non-invariance from the Michel parameter. R.Huerta-Quintanilla (Fermi Nat. Accelerator Lab., Batavia, IL, USA), J.L.Lucio M.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.369-70 (5 May 1983).
It is pointed out that the Michel parameter can be used to put a limit on a class of Lorentz non-invariant interactions. (6 refs.)

70382 Measuring gluon condensation. J.Chakrabarti (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.400-2 (5 May 1983).
Argues that the decay of the τ-lepton provides a reasonable basis for the determination of the masses of the light quarks. It also has a direct bearing on the estimates of gluon condensation. (7 refs.)

70383 A new experimental limit on electron stability. E.Bellotti, M.Corti, E.Fiorini, C.Liguori, A.Pullia, A.Sarracino, P.Sverzellati, L.Zanotti (Dipartimento di Fisica, Univ. di Milano, Milan, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.435-8 (5 May 1983).
Preliminary results are reported of an experiment on electron stability carried out with a Ge(Li) detector in the Mont Blanc laboratory at a depth of about 5000 mwe. No evidence was found either for the disappearance of K electrons in germanium atoms, or for the decay of electrons into a photon and a neutrino. Lower limits of 2×10^{22} and 3×10^{23} yr have been set for the corresponding half lifetimes. (11 refs.)

70384 On the mixings of heavy neutrinos and muon decays. M.S.Dixit (Nat. Res. Council of Canada, Ottawa, Ontario, Canada), P.Kalyniak, J.N.Ng.
Phys. Rev. D (USA), vol.27, no.9, p.2216-18 (1 May 1983).
The authors set limits on the mixing of heavy neutrinos into the muon family, $|U_{\mu i}|^2$, for neutrino masses in the range 30 to 70 MeV/c^2. Both the Michel parameter and the e^+ spectrum are used. This complements limits from leptonic decays of pseudoscalar mesons. They also give indications of how current experiments can be used to improve these limits. (12 refs.)

70385 Negative-norm states, superselection rules, and the lepton family. J.P.Crawford (Dept. of Phys., Univ. of Colorado, Denver, CO, USA), A.O.Barut.
Phys. Rev. D (USA), vol.27, no.10, p.2493-9 (15 May 1983).
Field theories containing states of both positive and negative norm are considered. With the correct definition of the number operators for the quantum fields, all physical quantities are rendered canonically normalized. If the theory admits a global symmetry leading to a superselection rule which forbids transitions between positive and negative-norm states, then the negative-norm states are allowed to be physical. Specifically, a spinor theory with higher-order field equations and multiple excitations is considered and applied to the charged lepton system: e, μ, τ. In this model, the negative norm of the muon state allows us to understand the nonexistence of $\mu\to e\gamma$ decay. For minimal coupling, the theory is renormalizable and equivalent to three separate fermion electrodynamics with the additional prediction of equal charge for the leptons. A further anomalous magnetic moment coupling can only allow one of the decays $\tau\to\mu\gamma$ or $\tau\to e\gamma$. (12 refs.)

Searches for rare decays of the muon and for μe conversion as experimental tests of muon number conservation .... See Entry 70271

Solrad 11 observations of the far-ultraviolet background .... See Entry 74183

13.40 ELECTROMAGNETIC PROCESSES AND PROPERTIES

13.40D Electromagnetic mass differences

70386 New formula for proton-neutron mass difference. I.Kimel (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Phys. Rev. D (USA), vol.27, no.9, p.2129-38 (1 May 1983).
A new formula is presented allowing the computation of the proton-neutron mass difference without the knowledge of the subtraction function in the dispersion integral. The Born terms contribute with the correct sign. The integral over the deep-inelastic region is finite whenever the Weinberg-'t Hooft mechanism is operative, and gives a small value. The net result is in very good agreement with the experimental value. (20 refs.)

Updated analysis of the quark-mixing matrix and its phenomenological implications .... See Entry 70351

13.40F Electromagnetic form factors; electric and magnetic moments

70387 Magnetic moments of light baryons in harmonic model. S.B.Khadkikar, S.K.Gupta (Internat. Centre for Theoretical Phys., Trieste, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.523-6 (12 May 1983).
Anomalous magnetic moments of light baryons are calculated in a relativistic harmonic oscillator model to obtain good agreement with experiment. (17 refs.)

70388 Linear symmetric quark theories of baryon magnetic moments. Y.Dothan (School of Phys. & Astron., Univ. of Minnesota, Minneapolis, MN, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2139-44 (1 May 1983).
A phenomenological and theoretical analysis of the baryon magnetic mmoments leads to a definition of the class of linear symmetric quark theories for the baryon moments. In this class of theories there are members that can reproduce the experimental results fairly well. However, it seems that despite SU(3) breaking the average of the light-quark magnetic moments $^1/_3(\mu_u+\mu_d+\mu_s)$ is unexpectedly small. A possible explanation is an anomalous moment for the quarks. (10 refs.)

Relativistic oscillator: linearly rising trajectories and structure functions .... See Entry 70195

Quark-confining potential and the form factors of pion and kaon .... See Entry 70325

Second order QCD prediction for direct photon production in e^+e^- annihilation .... See Entry 70337

Possible absorptive corrections in hard-scattering processes at very high energies .... See Entry 70340

On the axial charge and other static properties of the quark core in nucleons .... See Entry 70348

Bag-inspired gluonic and relativistic effects in a harmonic-oscillator model .... See Entry 70353

Structure functions of flavoured heavy hadrons in weak semi-leptonic decay .... See Entry 70370

Electron scattering from nuclear targets and quark distributions in nuclei .... See Entry 70394

Supersymmetry in two-photon processes .... See Entry 70400

The quark model and the nucleon-nucleon interaction .... See Entry 70460

13.40H Electromagnetic decays

70389 Two-photon decay of 2^+ mesons and $SU(3)_f$ symmetry breaking. P.Singer (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.531-4 (12 May 1983).
The consequences of a model for the transitions of tensor mesons to two photons are examined. The f^0, A_2^0, $f'\to 2_\gamma$ decays are expressed in terms of experimentally measured one-photon transitions of vector mesons to pseudoscalar mesons and remarkable agreement with experiment is demonstrated. The model requires the SU(3)-flavor symmetry breaking observed in vector meson radiative transitions to determine the pattern of symmetry breaking in radiative decays of tensor mesons. (19 refs.)

70390 Radiative decays of light- and heavy-flavor tensor mesons. P.Singer (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).
Phys. Rev. D (USA), vol.27, no.9, p.2223-6 (1 May 1983).
New data are used to reexamine $T\to V\gamma$ and $T\to\gamma\gamma$ decays. Their strength is determined from sum rules involving experimentally determined quantities. One of two models considered is in excellent agreement with the measured f^0, $A_2^0\to\gamma\gamma$ transitions. The model is extended to calculate radiative decays of strange and charmed tensor mesons. (23 refs.)

Analysis of radiative pion decay $\pi^-\to e^-\nu\gamma$ .... See Entry 70372

Decay of long-lived particles in the early Universe .... See Entry 73985

13.40K Electromagnetic corrections to strong and weak interaction processes

70391 Radiative corrections to the leptonic decays of pseudoscalar mesons: contributions of W and Z mesons. A.Garcia (Dept. de Fisica, Centro de Investigacion y Estudios Avanzados, Inst. Politecnico Nacional, Mexico, Mexico), A.Queijeiro.
Phys. Rev. D (USA), vol.27, no.9, p.2101-6 (1 May 1983).
Using the current-algebra formalism the authors calculate, within the Salam-Weinberg model, the contribution of the W and Z mesons to the radiative corrections to the leptonic decays of pseudoscalar mesons. (16 refs.)

Short-distance perturbation theory for the leading logarithm models .... See Entry 70328

Radiative corrections to neutrino-lepton scattering in the $SU(2)_L\otimes U(1)$ theory .... See Entry 70367

Radiative corrections to Z_0 jet asymmetries in e^+e^- annihilation .... See Entry 70397

13.60 PHOTON AND CHARGED-LEPTON INTERACTIONS WITH HADRONS

(for neutrino interactions, see 13.15)

70392 Leptoproduction of supersymmetric particles. S.K.Jones, C.H.Llewellyn Smith (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.145-71 (9 May 1983).
The authors study the production of scalar leptons $(\tilde{l})$, scalar quarks $(\tilde{q})$ and gluinos $(\tilde{g})$ in $ep\to\tilde{\nu}X$, and $ep\to\tilde{e}X$ and the associated production of $\tilde{q}$ and $\tilde{g}$ in $ep\to eX$ and $ep\to\nu X$. They find that $\tilde{\nu}\tilde{q}$ and $\tilde{e}\tilde{q}$ production is probably measurable at HERA for masses of order 40 GeV with exchanged particle masses of order 80 GeV. They derive and solve the asymptotic supersymmetric evolution equations for quark, gluon, scalar quark and gluino distributions. They find sum rules for the asymptotic momentum fractions and for the partition of the net quark number between quarks and scalar quarks. They use a fusion model to study associated leptoproduction in the threshold region. The only appreciable contribution is from small Q^2 electroproduction but the rates are low even for scalar quarks and gluinos with masses close to the present limits. (21 refs.)

13.60H Total and inclusive cross sections

(inc. deep-inelastic processes)

70393 Q^2-, and x_B- and W^2-dependence of hadron multiplicities and the Pati-Salam model. E.M.Santangelo (Dept. de Fisica, Univ. Nacional de La Plata, La Plata, Argentina).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.55-60 (14 May 1983).
The author considers the unexpected behaviour of hadron multiplicities in μp scattering found by the EMC collaboration (1982). A mechanism based on the Pati-Salam GUT (1976) is proposed to account for these experimental results. (9 refs.)

70394 Electron scattering from nuclear targets and quark distributions in nuclei. A.Bodek, N.Giokaris (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA), W.B.Atwood, D.H.Coward, D.J.Sherden, D.L.Dubin, J.E.Elias, J.I.Friedman, H.W.Kendall, J.S.Poucher, E.M.Riordan.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1431-4 (9 May 1983).
The deep-inelastic electromagnetic structure functions of steel, deuterium, and hydrogen nuclei have been measured with use of the high-energy electron beam at the Stanford Linear Accelerator Center. The ratio of the structure functions of steel and deuterium cannot be understood simply by corrections due to Fermi-motion effects. The data indicate that the quark momentum distributions in the nucleon become distorted in the nucleus. The present results are consistent with recent measurements with high-energy muon beams. (21 refs.)

13.60P Baryon and baryon resonance production

70395 P-odd effects in the deuteron electrodisintegration $e+d\to e^-+n+p$. M.P.Rekalo, G.I.Gakh, A.P.Rekalo.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.481-7 (April 1983). In Russian.
The general structure of *P*-odd polarization characteristics caused by the *P*-invariance violation in nuclear forces has been established for the deuteron electrodisintegration, $e^-+d\to e^-+n+p$. It is shown that *P*-odd effects may

arise in the $e^- + d \to e^- + n + p$ reaction when measuring the differential cross-section with the detection of the two particles in the final state, all particles in the initial and final states being unpolarized. The *P*-odd asymmetries arising in the collision of the polarized electrons with polarized deuterons have been considered. The *P*-odd contributions to the polarization of the recoil protons have also been calculated. (24 refs.)

70396 Polarization characteristics of the Δ-isobar in the $\gamma + p \to \pi^- + \Delta^{++}$ reaction. A.A.Zayats, I.L.Semisalov.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.487-92 (April 1983). In Russian.
The angular dependence of Δ-isobar polarization characteristics in the $\gamma + p \to \pi^- + \Delta^{++}$ reaction has been studied in terms of the model considering contributions of the $N^*(1470)$, $N^*(1519)$, $N^*(1652)$, $N^*(1672)$ nucleon resonances and a single-pion gradient-invariant mechanism with allowance for the absorption of lower partial waves. The calculation has been performed in the rest system of the Δ-isobar for γ-quantum energies of 0.7 and 1 GeV. Unpolarized initial particles and a polarized proton target are discussed. (14 refs.)

13.65 HADRON PRODUCTION BY ELECTRON-POSITRON COLLISIONS

70397 Radiative corrections to Z_0 jet asymmetries in e^+e^- annihilation. M.Consoli (Istituto di Fisica, Univ. di Catania, Catania, Italy), M.Greco.
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.237-44 (1 April 1983).
Electromagnetic and finite-width effects are discussed for $q\bar{q}$ jets produced in e^+e^- annihilation near the Z_0 pole. Angular asymmetries are also considered for inclusively produced π^+ and K^+ with large fractional momenta. (8 refs.)

70398 Can soft gluon effects be measured in electron-positron annihilation. J.Kodaira, L.Trentadue (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.693-7 (Feb. 1983).
The energy-energy correlations at large angles in e^+e^- annihilation is calculated by resumming soft gluon contributions through two-loop level. The result is compared with experimental data. No agreement is obtaining using a purely perturbative analysis. The relevance of nonperturbative effects at present energies is emphasized. (14 refs.)

70399 Inclusive electron production in e^+e^- annihilation at 29 GeV. M.E.Nelson, A.Blondel, G.H.Trilling, G.S.Abrams, D.Amidei, C.A.Blocker, A.M.Boyarski, M.Breidenbach, D.L.Burke, W.Chinowsky, W.E.Dieterle, J.B.Dillon, J.M.Dorfan, M.W.Eaton, G.J.Feldman, M.E.B.Franklin, G.Gidal, L.Gladney, M.S.Gold, G.Goldhaber, L.J.Golding, G.Hanson, R.J.Hollebeek, W.R.Innes, J.A.Jaros, A.D.Johnson, J.A.Kadyk, A.J.Lankford, R.R.Larsen, B.LeClaire, M.Levi, N.Lockyer, V.Luth, C.Matteuzzi, J.F.Patrick, M.L.Perl, B.Richter, P.C.Rowson, T.Schaad, H.M.Schellman, D.Schlatter, R.F.Schwitters, P.D.Sheldon, J.Strait, C.de la Vaissiere, J.M.Yelton, C.Zaiser (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1542-5 (16 May 1983).
The total momentum and transverse momentum spectra of electrons in e^+e^- annihilation at 29 GeV have been measured. The inclusive cross section is determined to be $14.4 \pm 1.6 \pm 5.2$ pb for momenta greater than 2 GeV/*c*. The average semielectronic branching ratios of charm and bottom quarks are measured to be $(6.3 \pm 1.2 \pm 2.1)\%$ and $(11.6 \pm 2.1 \pm 1.7)\%$, respectively. The fragmentation function for bottom quarks is determined to be peaked at high *z*, with $\langle z \rangle_b = 0.75 \pm 0.05 \pm 0.04$. (16 refs.)

70400 Supersymmetry in two-photon processes. E.Reya (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.424-8 (5 May 1983).
The effects of supersymmetry are studied in two-photon processes in particular for the photon structure function F_2^γ. Supersymmetry not only significantly influences the *x* dependence of F_2^γ but the direct production of scalar quarks also has pronounced effects in $F_2^\gamma(x,Q^2)$. In the threshold region such effects should be observable at LEP provided squark masses are not larger than of order $m_{W\pm}/2$; the absence of these effects puts lower limits on squark (slepton) masses. (14 refs.)

70401 Effect of weak interactions on e^+e^- annihilation into two jets in the integer charge quark model. S.Lakshmi Bala, G.Rajasekaran, S.D.Rindani.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.39
The process $e^+e^- \to 2$ jets is studied in the broken colour gauge theory with integer-charge quarks. The change in the angular distribution due to the neutral weak boson propagator and the weak-boson gluon coupling is obtained. The ratio R and the charge asymmetry have been calculated.

70402 e^+e^- annihilation into three jets in the integer-charge quark model. S.Lakshmi Bala, G.Rajasekaran, S.D.Rindani.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.40
The process $e^+e^- \to 3$ jets has been studied in the ICQ model with weak boson effects taken into account. The ratio of the cross-section for production of the three gluon jet to that of the $q\bar{q}g$ jets, as well as the thrust distribution, charge asymmetry and angular distribution of these jets have been calculated.

Second order QCD prediction for direct photon production in e^+e^- annihilation .... See Entry 70337

A survey of W pair production through the two-photon process .... See Entry 70366

13.75 HADRON-INDUCED LOW- AND INTERMEDIATE-ENERGY REACTIONS AND SCATTERING, ENERGY ≤ 10 GEV

(for higher energies, see 13.85)

Model hadron asymptotic behaviour .... See Entry 70361

13.75C Nucleon-nucleon interactions, including antinucleon, deuteron, etc. (energy ≤ 10 GeV)

(for N-N interactions in nuclei, see 21.30)

70403 Bounds on long-range hadronic interactions. L.Bracci, G.Fiorentini (INFN, Pisa, Italy), R.Tripiccione.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.215-47 (9 May 1983).
Bounds on long-range nucleon-nucleon interactions are obtained from the analysis of gravitational experiments, molecular spectroscopy and low and intermediate energy nuclear phenomena. Previously existing results are improved, and rather general types of potentials are considered: potentials behaving as $1/R^n$ and potentials corresponding to the exchange of scalar and pseudoscalar particles. (34 refs.)

70404 Spin effects in low energy proton-antiproton forward elastic scattering. M.Lacombe, B.Loiseau, B.Moussallam, Vinh Mau (Div. de Phys. Theorique, Inst. de Phys. Nucleaire, Orsay, France).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.443-5 (12 May 1983).
Predictions of the $\bar{p}p$ forward elastic cross section and of the real to imaginary ratio ρ given by the $N\bar{N}$ interaction the authors proposed recently are reported. Their cross sections compare very well with recent measurements at $400 < p_L < 730$ MeV/*c* and 700 MeV/*c*. It is also shown that spin effects cannot be neglected in the determination of ρ as usually assumed. (7 refs.)

70405 Differences between $\bar{p}p$ and pp interactions at 8.8 GeV/*c* and their relationship to $\bar{p}p$ annihilations. C.N.Booth, R.E.Ansorge, J.R.Carter, W.W.Neal, J.G.Rushbrooke, A.J.Simmons, D.R.Ward, T.O.White (Cavendish Lab., Univ. of Cambridge, Cambridge, England), R.A.Lewis, B.Y.Oh, M.Pratap, G.A.Smith, J.Whitmore.
Phys. Rev. D (USA), vol.27, no.9, p.2018-40 (1 May 1983).
The authors report on an experiment in which the SLAC 40-in. hybrid facility was exposed to an 8.8-GeV/*c* antiproton beam. Using external detectors they have identified a large fraction of nonannihilation events and thus obtained a clean sample of annihilation data. Using proton interactions taken in the same detector at the same energy they have made a detailed study of ($\bar{p}p$-pp) differences and explored their relationship to $\bar{p}p$ annihilations. (38 refs.)

70406 Description of elastic diffractional pp-scattering by overlapping functions. G.G.Arushanov, E.I.Ismatov, V.G.Arushanov, M.G.Sattarov, A.Yulchiev, M.S.Yakubov.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.498-505 (April 1983). In Russian.
Experimental data on proton-proton elastic scattering at FNAL and ISR energies in a wide range of transmitted pulses up to $-t = 15(\mathrm{GeV}/c)^2$ are described by inelastic overlapping functions taking into account absorbing effects. Both dependences of these functions are the transmitted pulse and pointing parameter and dependences of effective trajectories on *t* and *s* have been obtained. (16 refs.)

Meson-exchange Hamiltonian for *NN* scattering up to 1 GeV and Δ-nucleus dynamics .... See Entry 70459

The quark model and the nucleon-nucleon interaction .... See Entry 70460

The meson and quark-gluon degrees of freedom in NN-interaction at low and intermediate energies .... See Entry 70461

Spin-spin correlations and spin-asymmetries for the reaction $\vec{p}\vec{p} \to pn\pi^+$ at 510 MeV .... See Entry 70539

13.75G Pion-baryon interactions (energy ≤ 10 GeV)

Solution of Chew-Low equations in the quadratic approximation .... See Entry 70362

13.75J Kaon-baryon interactions (energy ≤ 10 GeV)

70407 Damping state method and kaonic bound states. M.Atarashi (Dept. of Phys., Hiroshima Univ., Hiroshima, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.589-601 (Feb. 1983).
A damping state method in the radiation field is generalized in the case of a multi-channel system with strong interactions. This approach is applied to the analysis of the K^--p system, where experimental complex level shifts of the 1*s* state are considerably different from the previous predictions. For the elementary interaction the author uses the nonlocal potential of a separable type, which reproduces not only measured values of the K^--N cross section but also effective properties of the resonance $Y_0^*(1405)$ and K^--N scattering length. The author's results for the complex level shift of the 1*s* state are consistent with the present experimental results. (18 refs.)

13.85 HADRON-INDUCED HIGH- AND SUPER-HIGH-ENERGY INTERACTIONS, ENERGY > 10 GEV

(for low energies, see 13.75)

Model hadron asymptotic behaviour .... See Entry 70361

13.85D Elastic scattering (energy > 10 GeV)

70408 Soft π^-p and pp elastic scattering in the energy range 30 to 345 GeV. J.P.Burq, M.Chemarin, M.Chevallier (Inst. de Phys. Nucleaire, Univ. de Lyon-Villeurbanne, France), A.S.Denisov, C.Dore, T.Ekelof, J.Fay, P.Grafstrom, L.Gustafsson, E.Hagberg, B.Ille, A.P.Kashchuk, G.A.Korolev, A.V.Kulikov, S.Kullander, M.Lambert, J.P.Martin, S.Maury, M.Querrou, V.A.Schegelsky, E.M.Spiridenkov, I.I.Tkach, M.Verbeken, A.A.Vorobyov.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.2, p.285-35 (23 May 1983).
Differential cross sections for π^-p and pp elastic scattering have been measured at incident momenta ranging from 30 to 345 GeV and in the *t* range $0.002\ (\mathrm{GeV}/c)^2 \leq |t| \leq 0.04\ (\mathrm{GeV}/c)^2$. From the analysis of the data, the ratio $\rho\ (t=0)$ of the real to the imaginary parts of the forward scattering amplitude was determined together with the logarithmic slope *b* of the diffraction cone. The results on the real parts confirm the validity of the forward dispersion relations at high energies. Using the dispersion relations, it was shown that the experimental data on $\rho_{\pi^-p}(t=0)$ require a continuous rise of the total πp cross sections, at least up to the energy of 2000 GeV, thus revealing a close similarity in high-energy behaviour of πp and pp interactions. The results on the slope parameters show consistency with the hypothesis of a universal shrinkage of the hadronic diffraction cone at high energies.

The value of the asymptotic shrinkage parameter α_p' was found to be independent of the kind of the incident hadron and of the momentum transfer. (55 refs.)

70409 Pion-proton backward elastic scattering between 30 and 90 GeV/*c*. W.F.Baker, D.P.Eartly, J.S.Klinger, A.J.Lennox, R.Rubinstein (Fermi Nat. Accelerator Lab., Batavia, IL, USA), R.M.Kalbach, A.E.Pifer, P.A.Polakos.
Phys. Rev. D (USA), vol.27, no.9, p.1999-2017 (1 May 1983).
Backward elastic scattering of $\pi^{\pm}$ on protons has been measured for incident pion momenta between 30 and 90 GeV/*c* and $0 \leq -u \leq 0.5$ (GeV/*c*)^2. The *u* dependence of the cross sections is similar to that observed at lower momenta, and Regge models give acceptable fits to the data. (35 refs.)

70410 Possible existence of further dip structures in πp and Kp elastic collisions. C.H.Lai, S.Y.Lo, K.K.Phua (Dept. of Phys., Nat. Univ. of Singapore, Kent Ridge, Singapore).
Phys. Rev. D (USA), vol.27, no.9, p.2214-15 (1 May 1983).
Dip structures in the differential cross sections of πp and Kp elastic collisions are investigated using the Chou-Yang model. Variation of the dip positions with total cross section is also presented. (5 refs.)

13.85F Inelastic scattering, two-particle final states (energy > 10 GeV)

70411 Analysis of $\pi^- p \to \pi^0 n$ scattering at high energies. Fazal-e-Aleem, M.Saleem (Dept. of Phys., Punjab Univ., Lahore, Pakistan).
Phys. Rev. D (USA), vol.27, no.9, p.2068-75 (1 May 1983).
The differential cross sections for $\pi^- p \to \pi^0 n$ including the recent measurements up to $-t \approx 2.2$ (GeV/*c*)^2, the polarization, and the difference $\Delta\sigma = \sigma_{tot}(\pi^+ p) - \sigma_{tot}(\pi^- p)$ are fitted in the region of high energy by using a ρ+cut model. The $I_t = 1$ amplitudes deduced from the model for $\pi^- p \to \pi^0 n$ are found to be in good agreement with those obtained by amplitude-analysis results of $\pi N \to \pi N$ at 6 GeV/*c*. (37 refs.)

A quark model calculation of the weak parity violating asymmetry in high-energy proton-nucleon scattering ....See Entry 70246

13.85H Inelastic scattering, many-particle final states (energy>10GeV)

Spin effects in hadronic collisions at large momentum transfers ....See Entry 70412

13.85K Inclusive reactions, including total cross sections, (energy > 10 GeV)

70412 Spin effects in hadronic collisions at large momentum transfers. J.Szwed (Inst. of Computer Sci., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.4, p.239-80 (April 1983).
The role of spin in hadron-hadron collisions at large p_T is investigated. The short distance diagrams and the end-point ($x \to 1$) contribution give phenomenologically similar results for the elastic nucleon-nucleon differential cross-section but differ significantly when looking at the spin-spin asymmetries. The spin analysis suggests the dominance of the end-point diagrams at large angles and present energies. The limits on the nucleon wave function are obtained from the comparison of spin effects in exclusive and inclusive reactions. Higher order results in exclusive channels are reviewed. In the inclusive production the author proposes a simple model of baryon polarization at large transverse momentum which accounts qualitatively for all experimental data in these processes. Other models are also reviewed. The whole investigation suggests that the spin effects are a relatively clear probe of the complicated hadron dynamics. (66 refs.)

70413 Inclusive production of the charmed baryon Λ_c^+ in nCH-interactions near 55 GeV. D.T.Burilkov, V.I.Genchev, I.M.Geshkov, P.K.Markov (Inst. of Nuclear Res. & Nuclear Energetics, Bulgarian Acad. of Sci., Sofia, Bulgaria), A.N.Aleev, V.A.Arefiev, B.P.Balandin, V.K.Birulev, V.D.Cholakov, A.S.Chvyrov, T.S.Grigalashvili, B.N.Gus'kov, I.M.Ivanchenko, I.N.Kakurin, N.N.Karpenko, D.A.Kirillov, I.G.Kosarev, V.R.Krastev, B.A.Kulakov, N.A.Kuz'min, M.F.Likhachev, A.L.Lyubimov, A.B.Maksimov, A.N.Morozov, Ngueng Mong Zao, A.E.Senner, L.V.Sil'vestrov, V.E.Simonov, L.A.Slepets, M.Smizanska, G.G.Sultanov, G.G.Takhtamyshev, P.T.Todorov, R.K.Trayanov, K.-H.Hiller, H.Nowak, A.V.Pose, H.-E.Ryseck, A.S.Belousov, A.M.Fomenko, E.I.Malynovsky, S.V.Rusakov, Yu.V.Soloviev, P.N.Shareiko, L.N.Shtarkov, Ya.A.Vazdyk, E.A.Chudakov, J.Hladky, S.Nemecek, M.Novak, A.Prokes, V.J.Zayachky, V.P.Dzhordzhadse, V.D.Kekelidze, N.L.Lomidze, G.I.Nikobadze, R.G.Shanidze, K.D.Marinov, M.V.Tosheva.
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.49-57 (1983).
The charmed baryon Λ_c^+ inclusive production and its decay mode $\Lambda_c^+ \to \bar{K}^0 p\pi^+ n^-$ have been observed in neutron-CH-interactions near 55 GeV. The experiment is performed using the BIS-2 spectrometer located in the neutron beam of the Serpukhov accelerator. The mass of the Λ_c^+ is measured to be 2282 ± 9 MeV/c^2. The cross-section for Λ_c^+ production in nCH-interactions times the branching ratio in the observed channel is estimated to be (31 ± 5) μb with systematical error ~50%. The new data confirm the previous results (Aleev et al., 1981) for Λ_c^+ production in nC-interactions near 58 GeV.

70414 The production of high-momentum particles and resonances in pp collisions at the CERN Intersecting Storage Rings. G.J.Bobbink, M.A.Van Driel, F.C.Erne, W.G.J.Langeveld, J.C.Sens (Nat. Inst. for Nuclear & High-Energy Phys., Amsterdam, Netherlands), D.Favart, P.Leleux, M.M.Block, R.Campanini, H.W.Ludwig, M.A.Botje, R.J.Goossens, P.Hoppenbrouwers, B.Van Uitert.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.11-30 (9 May 1983).
Data are reported on the momentum distributions of Λ, $\Lambda(1520)$, $\phi(1020)$, $\bar{\Lambda}$ and $\bar{p}$, inclusively produced between 1° and 2° with respect to one of the primary proton beams at the CERN Intersecting Storage Rings. In addition, the decay angular distribution of the $\Lambda(1520)$, the ratio of the cross sections for the production of $\Sigma^-(1385)$ and $\Sigma^+(1385)$ and the ratios among different charge states of the pairs $\Lambda\pi$, ΛK, $\Delta^{++}(1232)\pi$ and $\pi\pi$ have been measured. These data are confronted with current ideas on fragmentation. (29 refs.)

70415 pp production cross-sections and the constraint method. J.C.Anjos, A.F.S.Santoro, M.H.G.Souza (Centro Brasileiro de Pesquisas Fisicas, CBPF/CNPq, Rio de Janeiro, RJ, Brazil), E.Pedrazzi.
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.15, p.491-4 (9 April 1983).
A method of constructing production cross-sections that satisfy the constraints represented by the first few moments is shown to give an excellent account of the data when applied to the high-energy pp production cross-sections $\sigma_n(s)$ plotted as functions of *n*. (8 refs.)

70416 Single-jet events at the proton-antiproton collider—a possible interpretation via top flavor. R.M.Godbole (Dept. of Phys., Univ. of Bombay, Bombay, India), S.Pakvasa, D.P.Roy.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1539-41 (16 May 1983).
Pair production of a very heavy flavor like top leads to large-p_T isolated electrons back to back with jets as observed by Arnison et al. (1983). With a top-quark mass ~35 GeV, one can account for all the experimental features of these single-jet events available so far. Further tests for this interpretation are suggested. (7 refs.)

70417 Are there new effects in the ISR and collider $\bar{p}p$ and pp data?. P.Gauron, B.Nicolescu (Div. de Phys. Theorique, Inst. de Phys. Nucleaire, Orsay, France).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.429-34 (5 May 1983).
The new ISR and collider $\bar{p}p$ and pp data are confronted with the possible presence of a $l=1$ singularity in the odd-under-crossing amplitude (the 'odderon'). The authors point out the compatibility of the data with the presence of a minimum in the difference between $\bar{p}p$ and pp total cross sections located at $\sqrt{s} \simeq 80$ GeV. The crucial necessity of having non-contradictory ISR data is emphasized. (28 refs.)

70418 Upper limits on beauty meson production in π^-collisions at 280 GeV/*c*. J.Badier (Ecole Polytech., Palaiseau, France), J.Bourcrot, J.Bourotte, G.Burgun, O.Callot, Ph.Charpentier, M.Crozon, D.Decamp, P.Delpierre, B.Gandois, R.Hagelberg, M.Hansroul, Y.Karyotakis, W.Kienzle, P.le Du, J.Lefrancois, Th.Leray, J.Maillard, A.Michelini, Ph.Mine, G.Rahal, O.Runolfsson, P.Siegrist, A.Tilquin, J.Valentin, R.Vanderhaghen, S.Weisz.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.535-42 (12 May 1983).
From events with two like-sign muons, or with three or four muons, observed in the NA3 spectrometer with 280 GeV/*c* incoming π^- beam, the authors deduce upper limits on the production of beauty meson pairs $B\bar{B}$. They use the leptonic branching ratios of B meson measured at CESR storage rings, and assume that no nulcear effects occur in the platinum target. They find $\sigma(B\bar{B}) < 2$ nb/nucleon for centrally produced $B\bar{B}$ pairs, and $\sigma(B\bar{B}) < 10$ nb/nucleon for a diffractive production. These values are one order of magnitude lower than previously published limits. As a consequence, the $\psi\psi$ events observed in their experiment cannot come from $B\bar{B}$ decays. (19 refs.)

70419 Anomalous electron-pair production in 17-GeV/c $\pi^- p$ collisions. M.R.Adams, G.Abshire, C.Brown, E.S.Crandall, J.Goldberger, P.D.Grannis, B.T.Meadows, J.Stekas (State Univ. of New York, Stony Brook, NY, USA), G.J.Donaldson, H.A.Gordon, G.R.Morris, P.Rehak, L.Cormell.
Phys. Rev. D (USA), vol.27, no.9, p.1977-98 (1 May 1983).
The authors have measured inclusive e^+e^- production in 17-GeV/*c* $\pi^- p$ collisions and find anomalously large cross sections for pair masses below 0.6 GeV/c^2 and Feynman $x < 0.5$. Charged particles and photons produced in association with e^+e^- were measured. Decays of known resonances are not capable of explaining the effect. No excess of photons or charged particles associated with the anomalous pairs is detected. Implications of the results for various models and for direct single-electron and photon production are discussed. (41 refs.)

70420 Higgs-boson production in p-$\bar{p}$ collisions at collider energies. S.F.Novaes (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Phys. Rev. D (USA), vol.27, no.9, p.2211-13 (1 May 1983).
The author shows that the contribution of gluon fusion to Higgs-boson production in proton-antiproton collisions is much smaller than what has been predicted before for large Higgs-boson masses. (8 refs.)

70421 Triggering on high-transverse-momentum jets. H.E.Miettinen (Phys. Dept., Rice Univ., Houston, TX, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2236-8 (1 May 1983).
The author compares the characteristics of events selected by 'global' and 'two-high' triggers in large-transverse-energy hadron-hadron collisions. Using a QCD-based Monte Carlo model of Fox and collaborators (1982) the author finds that the former is effectively a high-multiplicity trigger, the latter a high-planarity trigger favoring unusually clean jet events. Predictions of the model for both triggers are in good qualitative agreement with recent data. (7 refs.)

70422 Direct photon pair production in hadron collisions as a test of integer-charge quark model. T.Jayaraman, G.Rajasekaran, S.D.Rindani (Dept. of Theoretical Phys., Univ. of Madras, Madras, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.41
The authors have studied the process $pp(p\bar{p}) \to \gamma\gamma X$ as a test of the integer-charged quarks in a gauge theory of broken colour. They have calculated the cross section arising due to both the quark and gluon contributions. They have examined the sensitivity of the cross section to the variation of the quark and gluon distribution functions.

Majorana neutrinos and the production of the right-handed charged gauge boson ....See Entry 70276

$\psi\psi$ production by quarks, gluons and B mesons ....See Entry 70334

Mass number dependence of large transverse momentum production and massive lepton pair production: effects of multi-quark clusters on high energy reactions off nuclear targets ....See Entry 70343

13.85M Cosmic ray interactions

(see also 94.40 Cosmic rays)

70423 Evidence for a new stable particle with heavy mass around 10^{17} eV. H.Sakuyama, N.Suzuki (Dept. of Phys., Meisei Univ., Hino, Tokyo, Japan).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.1, p.17-20 (7 May 1983).
The authors have conducted an experimental search for heavy stable particles near 10^{17} eV. A fast plastic scintillator-photomultiplier arrangement was used. (10 refs.)

13.88 POLARISATION IN INTERACTIONS AND SCATTERING

P-odd effects in the deuteron electrodisintegration $e + d \to e^- + n + p$ ....See Entry 70395

Polarization characteristics of the Δ-isobar in the $\gamma + p \to \pi^- + \Delta^{++}$ reaction ... .See Entry 70396

Spin effects in hadronic collisions at large momentum transfers ....See Entry 70412

Spin-spin correlations and spin-asymmetries for the reaction $\vec{p}\vec{p} \to pn\pi^+$ at 510 MeV ....See Entry 70539

13.90 OTHER TOPICS IN SPECIFIC REACTIONS AND PHENOMENOLOGY OF ELEMENTARY PARTICLES

70424 A calculation of $Z^0 \rightarrow 2$ gluinos. G.L.Kane (Randall Lab. of Phys., Univ. of Michigan, Ann Arbor, MI, USA), W.B.Rolnick.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B217, no.1, p.117-24 (9 May 1983).
The authors report the results of a one-loop calculation of $Z^0 \rightarrow \tilde{g}\tilde{g}$, where $\tilde{g}$ is a gluino, the proposed supersymmetric partner of a gluon. Depending on the masses of the scalar quarks and of the top quark, the branching ratio for the decay is in the 10^{-5} to 10^{-4} range for gluino mass below about 40 GeV. The signature for gluinos should allow detection in this range. (6 refs.)

Evaporation, annihilation and strong decays of long-lived quarkonia as finite-to-null and null-to-finite temperature processes .... See Entry 70181

Decay of weak vector bosons in the broken colour gauge theory with integer charge quarks .... See Entry 70308

Decay properties of massless bound gluinos .... See Entry 70335

A survey of W pair production through the two-photon process .... See Entry 70366

Supersymmetry in two-photon processes .... See Entry 70400

14.00 PROPERTIES OF SPECIFIC PARTICLES AND RESONANCES

14.20 BARYONS AND BARYON RESONANCES

(inc. antiparticles)

Charm production and charm decay in left-right (L-R) symmetric models without 'manifest' L-R symmetry .... See Entry 70234

Experimental test of baryon conservation: a new limit on neutron-antineutron oscillations in oxygen .... See Entry 70274

n-n̄ oscillation, H-H̄ oscillation and the double proton decay—are they suppressed by wave function effects? .... See Entry 70294

Three lepton decay of proton in a fractionally charged quark $SU(4) \times SU(2)_L \times SU(2)_R$ model .... See Entry 70295

A flux tube model for hadrons .... See Entry 70311

The SVZ method: why it works and why it fails .... See Entry 70315

Nucleon resonances and the quark model .... See Entry 70347

Topological theory of hadrons. II. Baryons .... See Entry 70358

Right-handed current effects in $\Delta S = 1$ semileptonic decays .... See Entry 70377

Observable gravitationally induced baryon decay .... See Entry 70378

Proton decay inside the nucleus .... See Entry 70379

On $n \rightarrow \bar{p} + e^+ + \nu_e$ .... See Entry 70380

New formula for proton-neutron mass difference .... See Entry 70386

Magnetic moments of light baryons in harmonic model .... See Entry 70387

Polarization characteristics of the Δ-isobar in the $\gamma + p \rightarrow \pi^- + \Delta^{++}$ reaction .... See Entry 70396

Inclusive production of the charmed baryon Λ_c^+ in nCH-interactions near 55 GeV .... See Entry 70413

14.40 MESONS AND MESON RESONANCES

Mass spectra of new particles .... See Entry 70176

Monte Carlo simulation of SU(2) lattice gauge theory with internal quark loops .... See Entry 70229

Charm production and charm decay in left-right (L-R) symmetric models without 'manifest' L-R symmetry .... See Entry 70234

The non-perturbative parameter in the SVZ sum rules cannot be $\langle 0 | (\alpha_s/\pi) G_{a\mu\nu} \cdot G_a^{\mu\nu} | 0 \rangle$ .... See Entry 70266

A calculation of the electromagnetic vacuum polarization in lattice QCD .... See Entry 70302

A flux tube model for hadrons .... See Entry 70311

The SVZ method: why it works and why it fails .... See Entry 70315

Quark-confining potential and the form factors of pion and kaon .... See Entry 70325

Failure of a recently proposed $q\bar{q}$ potential to reproduce heavy quarkonium spectroscopy .... See Entry 70327

Glueballs in the two-step potential model .... See Entry 70329

Glueballs and a tensor dominance model .... See Entry 70330

QCD charmonium sum rules up to $O(G^4)$ order .... See Entry 70332

A large mixing effect on η, η' and ι .... See Entry 70333

$\psi\psi$ production by quarks, gluons and B mesons .... See Entry 70334

Anticipated $t\bar{t}$ states in the quark-confining two-step potential model .... See Entry 70341

Top-quark mass and bottom-quark decay .... See Entry 70345

ψ and Υ systems in a consistent quark model .... See Entry 70350

Updated analysis of the quark-mixing matrix and its phenomenological implications .... See Entry 70351

Topological theory of hadrons. I. Mesons .... See Entry 70357

Structure functions of flavoured heavy hadrons in weak semi-leptonic decay .... See Entry 70370

Search for massive neutrinos in the decay $\pi \rightarrow e\nu$ .... See Entry 70371

Test for a heavy, long-lived neutral boson from $K_{\pi 2}$ decay in neutrino beams .... See Entry 70373

On the D^0-D^+ lifetime problem: evaluation of interference and W-exchange effects .... See Entry 70374

Branching-ratio predictions for the $\iota(1440)$ .... See Entry 70375

Quark-quark interaction and $K \rightarrow 2\pi$ decays .... See Entry 70376

Two-photon decay of 2^+ mesons and $SU(3)_f$ symmetry breaking .... See Entry 70389

Single-jet events at the proton-antiproton collider—a possible interpretation via top flavor .... See Entry 70416

Upper limits on beauty meson production in π^- collisions at 280 GeV/c .... See Entry 70418

14.60 LEPTONS

Space-time symmetries and the gravitational-neutrino field equations in general relativity .... See Entry 69955

An $SU(2) \otimes U(1)$ model with massive neutrinos and CP violation in the leptonic sector .... See Entry 70244

Chiral properties of supersymmetric vacua .... See Entry 70258

Searches for rare decays of the muon and for μe conversion as experimental tests of muon number conservation .... See Entry 70271

Majorana neutrinos and the production of the right-handed charged gauge boson .... See Entry 70276

On some tests of the basic properties of the neutral weak interaction. I. With massless neutrinos .... See Entry 70305

On some tests of the basic properties of the neutral weak interaction. II. With massive neutrinos .... See Entry 70306

The K-factor in the Drell-Yan process and the test of asymptotic freedom .... See Entry 70339

The structure of quarks and leptons .... See Entry 70360

Constraints on light particles from kaon decays .... See Entry 70369

Search for massive neutrinos in the decay $\pi \rightarrow e\nu$ .... See Entry 70371

Measuring gluon condensation .... See Entry 70382

A new experimental limit on electron stability .... See Entry 70383

On the mixings of heavy neutrinos and muon decays .... See Entry 70384

Supersymmetry in two-photon processes .... See Entry 70400

Double beta decay, massive neutrinos and lepton conservation .... See Entry 70493

Double beta decay—an experimental review .... See Entry 70494

Geochemical double beta decay experiments .... See Entry 70495

The Irvine ^{82}Se experiments .... See Entry 70496

Early results from the Battelle-Carolina ^{76}Ge double beta decay project .... See Entry 70497

The status of the UCSB-LBL ^{76}Ge double beta decay experiment .... See Entry 70498

Recent results obtained in the Mt. Blanc experiment on $\beta\beta$ decay of ^{76}Ge .... See Entry 70499

Is the neutrino mass equal to 34 eV?—A discussion of the atomic effect in the β-decay of ^{3}H .... See Entry 70503

Double beta decay .... See Entry 70504

Decay of long-lived particles in the early Universe .... See Entry 73985

Solrad 11 observations of the far-ultraviolet background .... See Entry 74183

The influences of massive neutrinos on clustering in the early Universe .... See Entry 74188

14.80 OTHER AND HYPOTHETICAL PARTICLES

70425 Binding of magnetic monopoles and atomic nuclei. L.Bracci, G.Fiorentini (Istituto di Fisica, Univ. di Pisa, Pisa, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.493-6 (12 May 1983).
The authors discuss the possibility that magnetic monopoles bind to atomic nuclei. They estimate the binding energy of these systems to be in the range 10-100 keV and the formation cross section to be $\sigma_{\rm for} \gtrsim 10^{-28}$ cm^2. They find that most likely monopoles reaching Earth are bound to a proton and present bounds on the monopole flux. (10 refs.)

The electrodynamics with magnetic monopoles. II. Canonical formalism .... See Entry 69902

Vector bundle representations of groups in quantum physics .... See Entry 69912

Universal unfolding of Hamiltonian systems: from symplectic structure to fiber bundles .... See Entry 69932

Unification of generalized electromagnetic and gravitational fields .... See Entry 69958

Angular-momentum operators for dyons .... See Entry 70179

Evaporation, annihilation and strong decays of long-lived quarkonia as finite-to-null and null-to-finite temperature processes .... See Entry 70181

The fine-structure constant, magnetic monopoles and Dirac charge quantization condition .... See Entry 70182

Critical-voltage law for chiral particle production near a monopole .... See Entry 70183

Systematic derivation of Prasad-Sommerfield solution .... See Entry 70235

Two potential electrodynamics for the particles carrying both the electric and magnetic charges .... See Entry 70238

Interaction of particles carrying both the electric and magnetic charges in predictive relativistic mechanics .... See Entry 70239

Generalized fields associated with dyons .... See Entry 70240

General results on the low energy effective theory for $N=1$ local supersymmetry .... See Entry 70257

Chiral properties of supersymmetric vacua .... See Entry 70258

Cosmological character of the Higgs field .... See Entry 70268

Monopoles underground .... See Entry 70269

Constraint on the photino mass from cosmology .... See Entry 70275

Majorana neutrinos and the production of the right-handed charged gauge boson .... See Entry 70276

Monopole topology and the problem of colour .... See Entry 70277

Unification incorporating observable fractional charge, magnetic monopole and maphon .... See Entry 70280

On the calculability of $W_L{}^+$-$W_R{}^+$ gauge mixing .... See Entry 70286

Monopole catalysis of proton decay in SO(10) grand unified models .... See Entry 70288

Supersymmetric grand unified theories and cosmology .... See Entry 70291

Hydrogen-antihydrogen oscillations in a fractionally charged Pati-Salam model ....See Entry 70293

Fermion-monopole system reexamined ....See Entry 70303

Decay of weak vector bosons in the broken colour gauge theory with integer charge quarks ....See Entry 70308

Glueball formation in chromostatics ....See Entry 70312

The limit $m_q \rightarrow 0$ of perturbative QCD ....See Entry 70317

Decay properties of massless bound gluinos ....See Entry 70335

Glueballs multiquark states and the OZI rule ....See Entry 70336

Top-quark mass and bottom-quark decay ....See Entry 70345

The structure of quarks and leptons ....See Entry 70360

A survey of W pair production through the two-photon process ....See Entry 70366

Measuring gluon condensation ....See Entry 70382

Radiative corrections to the leptonic decays of pseudoscalar mesons: contributions of W and Z mesons ....See Entry 70391

Inclusive electron production in e^+e^- annihilation at 29 GeV ....See Entry 70399

Supersymmetry in two-photon processes ....See Entry 70400

Higgs-boson production in p-$\bar{p}$ collisions at collider energies .. See Entry 70420

Evidence for a new stable particle with heavy mass around 10^{17} eV ....See Entry 70423

A calculation of $Z^0 \rightarrow 2$ gluinos ....See Entry 70424

Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector ....See Entry 70745

Electroweak effects in p-wave superconductors ....See Entry 72538

20.00 NUCLEAR PHYSICS

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received) ....See Entry 69785

21.00 NUCLEAR STRUCTURE

21.10 GENERAL AND AVERAGE PROPERTIES OF NUCLEI; PROPERTIES OF NUCLEAR ENERGY LEVELS

(for properties of specific nuclei listed by mass ranges, see 27.)

70426 Investigation of the decay of oriented ^{145}Eu nuclei. V.A.Deryuga (Kharkov State Univ., Kharkov, Ukrainian SSR), T.I.Kratsikova, M.Finger, Ya.Dupak, A.N.Vdovin, W.D.Hamilton.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.23-30 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.860-6 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
Studies the decay of ^{145}Eu nuclei oriented at ultralow temperatures for the first time. The multipolarity-mixing parameters have been determined for a large number of transitions, and the spins of a series of levels of ^{145}Sm have been established uniquely or refined. Certain properties of the low-lying states of ^{145}Sm have been analysed within the framework of the quasi-particle-phonon semimicroscopic model of the nucleus. (22 refs.)

70427 Investigation of the decay of oriented ^{147}Eu nuclei. V.A.Deryuga (Kharkov State Univ., Kharkov, Ukrainian SSR), T.I.Kratsikova, M.Finger, V.M.Tsupko-Sitnikov, Yu.V.Yushkevich.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.31-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.867-73 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The authors studied the decay of ^{147}Eu nuclei oriented at ultralow temperatures in iron and gadolinium matrices for the purpose of obtaining new information on the multipolarity-mixing parameters of the transitions and the spins of the levels of ^{147}Sm. (30 refs.)

70428 Structure of the excited states of the odd isotopes of bromine ^{75,77,79,81,83}Br. V.E.Mitroshin, B.A.Nemashkalo, V.K.Chirt (B.P. Konstantinov Leningrad Inst. of Nuclear Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.41-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.877-84 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The odd isotopes of bromine $^{75-83}$Br are studied within the framework of a model that takes account of the coupling between the odd quasi-particle and the anharmonic vibrations of the spherical core. The fundamental features of the approach given, which distinguish it from existing approaches, reside in the following: (a) consideration of the Pauli principle for interaction between an odd quasi-particle and collective modes, and between quasi-particles forming collective degrees of freedom; (b) consideration of the influence of zero vibrations of the shape of the nucleus on the effective forces, the one-particle M1-, E1-, E2-moments and the spectroscopic factors; (c) the use of a unified representation for the wave function which is acceptable for the description of spherical, transitional and deformed nuclei. These differences allow the authors to hope for success in the description of both the 'rotational' and the 'vibrational' features of the dynamics of the bromine isotopes. (22 refs.)

70429 Excitation of the collective states of nuclei of the transitional region having A≈190 to 200 for inelastic scattering of low-energy neutrons. V.I.Popov, I.V.Surkova (Inst. of Nuclear Res., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.54-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.892-6 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
Presents the results of investigating the excitation of the 2_1^+ levels and, in certain cases, other collective levels of ^{188,190,192}Os, ^{194,196,198}Pt, ^{198,200,202,204}Hg and ^{206}Pb during inelastic scattering of neutrons near the reaction threshold. (12 refs.)

70430 Octupole states in the SO(6) limit. Di Yao-min (Jiangsu Normal Coll., China).
Chin. Phys. (USA), vol.3, no.1, p.118-28 (Jan.-March 1983). [received: May 1983]
The authors treat the octupole states in even-even nuclei using a system consisting of f^- boson and $N-1$ s^+, d^+ bosons. The SO(6) limiting case is emphasized and the analytic relations for energies and electromagnetic transition rates are derived. Finally the two-particle states are briefly discussed. (6 refs.)

70431 Identification of single-particle configurations at very high spin in $^{150-152}$Dy. D.Horn, O.Hausser, I.S.Towner, H.R.Andrews, M.A.Lone (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1447-50 (9 May 1983).
Gamma-gamma coincidence studies of $^{150-152}$ Dy have been performed with use of Compton-suppressed Ge(Li) detectors to resolve ambiguities in the high-spin structure of these nuclei. On the basis of I^π assignments, transition rates, and level systematics for $^{148-152}$Dy, the observed levels are interpreted as proton particle-hole excitations coupled to aligned valence neutron configurations. The proposed single-particle configurations are confirmed by shell-model calculations. (16 refs.)

70432 Yrast-Yrare interaction in Os nuclei. A.Neskakis, R.M.Lieder (Inst. fur Kernphys., KFA Julich, Julich, Germany), G.Sletten, G.D.Dracoulis.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1628-30 (16 May 1983).
Dracoulis, Fahlander, and Fewell (1980) have reported about yrast and yrare bands in light Os nuclei. The authors also studied ^{180}Os, using the reaction ^{182}W(α,6n) and the reaction ^{166}Er(^{18}O,4n). The partial level scheme of ^{180}Os disagrees with that given by Dracoulis, Fahlander, and Fewell. The discrepancy can be described as an interchange of the yrast and yrare bands. The states have the same energies, but some of the spin assignments are different, since Dracoulis, Fahlander, and Fewell consider the 527.5- and 699.1-keV γ rays as stretched $E2$ transitions whereas they identified them as unstretched $M1$ transitions. Furthermore they observed several new transitions which have not been seen by Dracoulis, Fahlander, and Fewell. The arguments for their assignments are presented. The following in the response by Dracoulis: the transitions, at 1051, 1094, and 1241 keV, were not observed in the author's coincidence data. Lines of those energies are evident in the author's singles measurements, but have not been assigned to ^{180}Os. (7 refs.)

70433 U(6/12) supersymmetries in nuclei. Sun Hong Zhou (Inst. de Fisica, Univ. Nacional Autonoma Mexico, Mexico City, Mexico), A.Frank, P.van Isacker.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.275-80 (5 May 1983).
The authors analyze three subgroup chains of U(6/12) appropriate for regions where uncoupled fermions can occupy $j=1/2$, 3/2 and 5/2 single particle orbits and present a possible manifestation of U(5) supersymmetry in the Hg isotopes. (14 refs.)

70434 Centroids and widths in the symplectic collective model. J.P.Draayer (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA), G.Rosensteel.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.281-3 (5 May 1983).
Methods of statistical spectroscopy are applied to the symplectic collective shell model. Analytic expressions are given for determining the distribution of U(3) centroids within an irreducible representation of Sp(3,$\mathbf{R}$) for the Bohr-Mottelson collective $V(\beta, \gamma)$ potential. For ^{20}Ne, a comparison is made between statistical predictions and shell-model results for the U(3) content of states in the ground state domain. The results suggest that statistical measures can be used reliably to truncate symplectic model spaces so that microscopic calculations become feasible. (9 refs.)

70435 The interacting boson model in the germanium region. P.D.Duval (C.E. Bruyeres-le-Chatel, Montrouge, France), D.Goutte, M.Vergnes.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.297-301 (5 May 1983).
The Interacting Boson Model plus Configuration Mixing is tested in the germanium region. Results for ^{68}Ge$_{36}$ to ^{76}Ge$_{44}$ are given which show good overall agreement with energy levels, B(E2) values, quadrupole moments and, for the first time, two-neutron transfer cross sections. (21 refs.)

70436 Evidence for 3p-2h rotational bands in ^{17}O. A.Cunsolo, A.Foti, G.Imme, G.Pappalardo, G.Raciti (Istituto Nazionale di Fisica Nucleare, Catania, Italy), N.Saunier.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.439-42 (12 May 1983).
Comparison is made, in the weak coupling hypothesis, between the transitions to positive parity ^{17}O states selectively excited in the ^{14}C(^{6}Li, t)^{17}O reaction at E(^{6}Li)=34 MeV, and those from the ^{16}O(^{6}Li, t)^{19}Ne reaction at E (^{6}Li)=36 MeV, leading to the $K^\pi=1/2^+$ rotational band states in ^{19}Ne. The good results show the validity of the weak coupling hypothesis, and indicate the existence of two 3p-2h bands in the ^{17}O nucleus. The candidates for $L=0$, 2, 4 members of the $T=1/2$ rotational band and for $L=4$ member of the $T=3/2$ band are suggested. These findings are confirmed by the extracted ^{3}He-spectroscopic strengths. (11 refs.)

70437 Vibrations of the atomic nucleus. G.F.Bertsch.
Sci. Am. (USA), vol.248, no.5, p.40-51 (May 1983).
The nucleus can quiver, ring or even 'breathe'; the coordinated motion of the nuclear particles reveals much about the forces between them. Six modes of vibration have been detected so far. (no refs.)

70438 Study of spin-orbit interaction of ^{13}C and ^{15}N nuclei in ^{14}C induced transfer reactions on ^{138}Ba. W.von Oertzen, E.R.Flynn (Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany), J.C.Peng, J.W.Sunier, R.E.Brown.
Z. Phys. A (Germany), vol.310, no.4, p.275-85 (1983).
Angular distributions of single nucleon transfer reactions populating single particle states in the reactions ^{138}Ba(^{14}C, ^{15}N)^{137}Cs and ^{138}Ba(^{14}C, ^{13}C)^{139}Ba have been studied. The shapes of the angular distributions show differences for different final configurations. Using the reaction asymmetry it is possible to describe these differences consistently for all transitions by a spin-orbit potential. The polarisation of the outgoing fragments is discussed and its dependence on final configurations is explained. The spin-orbit potentials deduced from the reaction asymmetry are large, as compared to predictions of folding potentials. They are, however, consistent with measurements of spin-

flip probabilities. The origin of the *L-S* interaction is to be found in coupling effects of second order in the heavy ion reaction. (27 refs.)

70439 Non local effects induced by the particle-vibration coupling. O.Civitarese (Dept. de Fisica, Univ. Nacional de la Plata, La Plata, Argentina), R.P.J.Perazzo, S.L.Reich, M.Saraceno.
Z. Phys. A (Germany), vol.311, no.1-2, p.135-42 (1983).
Dynamical corrections to the single particle potential are (perturbatively) evaluated. The corrections to m^*/m resulting from the coupling of independent (effective) fermions to collective vibrations (low energy modes) are analyzed within the NFT formalism. The results for the ^{208}Pb are discussed. (23 refs.)

70440 Shell model studies of very neutron deficient Ru and Rh nuclei. A.Amusa, R.D.Lawson (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.51
The results of shell model studies carried out on account of the recent Munich group data on the high spin states of the neutron deficient ^{94}Ru and ^{95}Rh nuclei are presented. In the studies, ^{88}Sr is regarded as a closed core and proton configurations are restricted to the $(2p_{1/2}1g_{9/2})^n$ model space as Gloeckner and Serduke did in fitting the low spin data of these nuclei in 1974. Detailed structures of the various energy levels as well as gamma-decay transition rates between the levels were obtained. A comparison of the theoretical and experimental energy levels is shown. Apart from the disagreement between theory and experiment in the depopulation of the yrast 9^- state in ^{94}Ru, all the results agree with experimental spin assignments and decay modes. (3 refs.)

70441 High spin states and discrete line spectroscopy of ^{128}ce. J.L.S.Carvalho, R.M.Ronningen (Nat. Superconducting Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA), N.R.Johnson, J.S.Hattula, I.Y.Lee, M.P.Fewell, L.L.Riedinger, H.Ower, J.C.Wells, F.M.Bernthal.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.52
Nuclear shapes in the A~130 region are transitional between prolate-deformed and spherical. In such regions anomalous behavior in the yrast sequence (backbending) at high annular momentum results from the crossing of the ground state rotational band by an aligned quasiparticle band. In the deformed rare-earth region the quasiparticle band is composed of $i_{13/2}$ neutron states. But, in the A~130 region $h_{11/2}$ protons are involved. To investigate the role of the $h_{11/2}$ proton in this region the authors have studied ^{128}Ce. Levels in this nucleus were populated in the ^{112}Cd(^{20}Ne,4n) reaction at 103 MeV using the ORNL isochronous cyclotron. Seven Ge γ-detectors were used, all in the reaction plane. Two large NaI detectors, one placed above the target and one below, acted together as a total γ-ray energy spectrometer for reaction channel selection. The yrast sequence was observed to spin 24, and a strong back bend occurs around $\hbar\omega=0.31$ MeV. Two sidebands having two-quasiparticle nature were also observed, with bandheads at 1890 and 1989 keV. The former is tentatively assigned as the $h_{11/2}$ two quasi-proton band. (no refs.)

70442 High spin states in ^{129}Ce. R.Aryaeinejad, A.H.Nelson, D.J.G.Love, P.J.Nolan, P.J.Twin (Oliver Lodge Lab., Univ. of Liverpool, Liverpool, England), J.D.Garrett, G.B.Hagemann, B.Herskind.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.53
High spin states in ^{129}Ce have been studied using an ^{16}O beam on ^{116}Sn and ^{117}Sn targets at energies of 75 and 85 MeV, respectively. For the ^{117}Sn reaction, gamma-gamma coincidence data are obtained using an array of four escape suppressed Ge(Li) detectors on conjunction with 14 element bismuth germanate (BGO) sum energy and multiplicity spectrometer. The BGO spectrometer enables us to select the desired reaction channel. Two positive parity bands as well as two negative parity bands were observed in ^{129}Ce. The ambiguities about the relative positions of the positive and negative parity bands have also been resolved. All four bands show a strong first backbend at a rotational frequency of $h\omega=0.32$ MeV. This band crossing has been seen in ^{130}Ce and ^{131}Ce at the same frequency, but has not been observed in the odd proton nucleus ^{127}La, which indicates the alignment is due to $h_{11/2}$ protons. (2 refs.)

70443 Observations of large differences between mass and charge excitation of collective states. G.Graw, H.Clement, H.Kader, F.Merz, P.Schiemenz, N.Seichert (Sektion Phys., Univ. Munchen, Garching, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.57
Most of our precise knowledge about natural parity transition strengths to or between excited collective nuclear states results from electromagnetic processes and is thus restricted to the observation of changes in the charge distribution. Inelastic scattering of polarized deuterons with energies near 20 MeV allows for a rather reliable determination of the corresponding mass transition moments of light and heavy nuclei. In addition the authors investigated shell structure effects on proton-closed shell nuclei ^{18}O and ^{64}Ni and on the doubly-closed shell nucleus ^{48}Ca. (2 refs.)

70444 Microscopic study of molecular bands and their crossing. K.Kato, S.Okabe, Y.Abe (Dept. of Phys., Hokkaido Univ., Sapporo, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.74
The authors calculate energy spectra of the ^{28}Si nucleus by the use of semimicroscopic ^{12}C+^{16}O molecular wave functions and show that there exist molecular rotational bands and their crossing at the energy almost equal to that assumed in the phenomenological analysis. The speculation is disproved that the band crossing model (BCM) is not applicable to systems involving the strongly deformed ^{12}C nucleus. (3 refs.)

Two-rotor model of deformed nuclei .... See Entry 70446

The quadrupole moment of ^{176}Lu .... See Entry 70451

Single particle response in finite nuclei .... See Entry 70465

Ξ hypernuclei .... See Entry 70480

Study of nuclear transitions from aligned states using the example of octupole bands in actinides .... See Entry 70481

γ-decay of the states of ^{55,56}Fe excited in the (n,xnγ) reaction on ^{56}Fe at E_n=14.6 MeV .... See Entry 70482

Angular distributions of γ-quanta from the ^{93}Nb(n,n′γ) reaction .... See Entry 70483

Multiplicity of gamma-ray transitions in the reaction ^{160}Gd(^{16}O,xn)$^{176-x}$Hf. I .... See Entry 70484

The interacting boson model applied to the mercury isotopes .... See Entry 70492

Investigation of the decay of ^{165}Tm→^{165}Er .... See Entry 70500

A phenomenological imaginary part of the optical potential for heavy ions .... See Entry 70524

Gamma-ray polarization and nuclear orientation measurements on ^{182}TaFe .... See Entry 70541

On the suppression of multiple rotational excitation in heavy ion inelastic scattering above the Coulomb barrier .... See Entry 70573

Mutual inelastic excitations .... See Entry 70620

Spin of the E_{CM}=30 MeV intermediate width resonance in ^{12}C+^{12}C inelastic scattering .... See Entry 70622

A note on the time scale for fusion of heavy ions .... See Entry 70639

Multistep nature of heavy-ion fusion reactions .... See Entry 70640

21.10D Binding energy and masses

70445 Observation and mass measurement of ^{69}Ni. M.Bernas, Ph.Dessagne, M.Langevin, F.Pougheon, P.Roussel (Inst. de Phys. Nucleaire, Orsay, France), G.C.Morrison.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.54
Masses and properties of neutron rich medium mass nuclei are relevant for the knowledge of nucleosynthesis processes. Besides, the role of the proton shell closure on the nuclear well and the predictive power of mass formulae can be followed on the heavier Ni isotopes. The authors have recently studied the ^{68}Ni nuclei with ^{70}Zn(^{14}C, ^{16}O) reaction (1981): mass has been remeasured and first excited level has been shown to be 0^+. They now report on the first observation and mass measurement of ^{69}Ni. Five mass units heavier than the last stable isotope, it is populated with the ^{70}Zn(^{14}C, ^{15}O) transfer reaction. (3 refs.)

Binding of magnetic monopoles and atomic nuclei .... See Entry 70425

Observations of large differences between mass and charge excitation of collective states .... See Entry 70443

The adiabatic approximation .... See Entry 70468

Flavour nuclei and one-boson-exchange potentials .... See Entry 70474

Bound states of negative pions and neutrons .... See Entry 70475

^{164}Ta, identification of a new isotope .... See Entry 70506

Structure of the mass operator in finite Fermi systems .... See Entry 70540

Formation of the mass and angular distributions of the products of reactions with heavy ions .... See Entry 70564

21.10F Shape, charge, radius and form factors

70446 Two-rotor model of deformed nuclei. G.de Franceschi, F.Palumbo (Laboratori Nazionali di Frascati, Istituto Nazionale di Fisica Nucleare, Frascati, Italy), N.Lo Iudice.
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.61-5 (14 May 1983).
The two-rotor model of deformed nuclei, already studied for $N=Z$, is reformulated using a more appropriate quantization procedure and extended to the case $N\neq Z$. While the neutron excess effects are negligible, the different quantization procedure has the effect of halving the excitation energy of the collective $M1$ state. (5 refs.)

70447 Deformation correlation effects in the ^{154}Sm-^{144}Sm neutron density difference. L.Ray (Dept. of Phys., Univ. of Texas, Austin, TX, USA), M.M.Gazzaly.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.309-13 (5 May 1983).
The second order Kerman, McManus and Thaler optical potential model (1959) is used in the analysis of 800 MeV proton elastic scattering data from ^{144,154}Sm. Correlation terms arising from the large intrinsic deformation of ^{154}Sm are included and are found to be quite significant. Neutron isotopic density distribution and RMS radius differences are determined and are seen to be in good agreement with deformed basis, Hartree-Fock predictions. (28 refs.)

70448 The mean free path of protons in nuclei and the nuclear radius. R.Dymarz, T.Kohmura (Nuclear Phys. Lab., Oxford, England).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.446-50 (12 May 1983).
The authors determine the mean free path of protons in nuclei in the energy range 40-1000 MeV. They find that it is necessary to use in the calculation of the mean free path the nuclear radius R which reproduces the reaction and total cross sections consistently and that this radius leads to a rather small mean free path which is comparable with the value obtained in the microscopic calculation in the whole energy region. (29 refs.)

70449 Electroexcitation of 2^+ and 4^+ states in ^{28}Si: a test of the renormalized shell model. S.Yen, B.O.Pich, T.E.Drake (Dept. of Physics, Univ. of Toronto, Ontario, Canada), C.F.Williamson, S.Kowalski, C.P.Sargent.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.471-3 (12 May 1983).
The electromagnetic form factors of the lowest five 2^+ and the lowest two 4^+ states in ^{28}Si are measured via high-resolution electron scattering for the first time. Comparison with the renormalized shell model calculations of Chung (1973) and Wildenthal (1978) reveals deficiencies in the shell model description of these states. (6 refs.)

High spin states and discrete line spectroscopy of ^{128}ce .... See Entry 70441

Observations of large differences between mass and charge excitation of collective states .... See Entry 70443

Level structure of ^{106}Mo .... See Entry 70452

Potential pockets in the ^{238}U+^{238}U system and their possible consequences .... See Entry 70463

Single particle response in finite nuclei .... See Entry 70465

The adiabatic approximation .... See Entry 70468

Variational calculation of nonuniform spin-ordered neutron matter including Δ isobar mixing .... See Entry 70479

Electron scattering from ^{13}C .... See Entry 70545

Elastic scattering of high energy alpha-particles on nuclei .... See Entry 70557

Moments of charge distributions in the reaction ^{92}Mo+^{92}Mo at 14.7 MeV/u .... See Entry 70576

Charge transfer prior to fusion .... See Entry 70580

Role of the deformation of multipolarity six in the dynamic description of spontaneous fission ....See Entry 70628

Strong enhancement of subbarrier fusion due to negative hexadecapole deformation ....See Entry 70637

21.10H Spin, parity, and isobaric spin

70450 The parity violating rotation of the neutron spin in helium. V.F.Dmitriev (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), V.V.Flambaum, O.P.Sushkov, V.B.Telitsin.
Phys. Lett. B (Netherlands), vol.125B, no.1, p.1-4 (19 May 1983).
The spin rotation angle for transversally polarized neutrons in liquid helium is calculated. The result is expressed in terms of a parity violating nucleon-nucleon interaction taken in the one-boson exchange approximation. For reasonable parameters of the interaction the spin rotation angle is equal to $\phi=(-0.1\pm1.5)\times10^{-6}$ rad/m. (18 refs.)

Investigation of the decay of oriented ^{145}Eu nuclei ....See Entry 70426

Investigation of the decay of oriented ^{147}Eu nuclei ....See Entry 70427

Identification of single-particle configurations at very high spin in $^{150-152}$Dy ....See Entry 70431

Yrast-Yrare interaction in Os nuclei ....See Entry 70432

Evidence for 3p-2h rotational bands in ^{17}O ....See Entry 70436

High spin states and discrete line spectroscopy of ^{128}ce ....See Entry 70441

High spin states in ^{129}Ce ....See Entry 70442

Shell-model relationships between negative-parity states of even-mass $A=30$-40 nuclei ....See Entry 70454

Identification of levels in ^{24}Mg populated in the reaction ^{12}C(^{14}Nd,d)^{24}Mg ....See Entry 70455

$\alpha+^{14}$C dinuclear molecular band in ^{18}O: a new perspective into heavy ion scattering resonant phenomena ....See Entry 70457

The adiabatic approximation ....See Entry 70468

Nuclear orientation of ^{147}Tb ($T_{1/2}=1.7$h), ^{149}Tb ($T_{1/2}=4.15$ h) and ^{151}Tb ($T_{1/2}=17.7$ h) in a gadolinium host ....See Entry 70485

Investigation of the decay of ^{165}Tm$\rightarrow^{165}$Er ....See Entry 70500

Spins and parities of the resonance states of ^{24}Mg which are excited in the ^{23}Na(p,α)^{20}Ne and ^{23}Na(p,p$_h$)^{23}Na* reactions for $E_p=6.27$, 6.37 and 6.52 MeV ....See Entry 70525

Microscopic study of ^{16}O+^{15}N ....See Entry 70529

Measurement of the polarization parameter P in π^+p elastic scattering in the region of low-lying pion-nucleon resonances ....See Entry 70542

Molecular resonances and spin alignment in ^{12}C+^{16}O inelastic scattering ....See Entry 70574

High resolution excitation function measurements and resonant structures in the ^{16}O-^{16}O-system at the Coulomb barrier ....See Entry 70621

Spin of the $E_{CM}=30$ MeV intermediate width resonance in ^{12}C+^{12}C inelastic scattering ....See Entry 70622

Spin alignment in ^{12}C+^{12}C inelastic scattering ....See Entry 70623

21.10J Spectroscopic factors

Structure of the excited states of the odd isotopes of bromine ^{75,77,79,81,83}Br ....See Entry 70428

Evidence for 3p-2h rotational bands in ^{17}O ....See Entry 70436

21.10K Electromagnetic moments

70451 The quadrupole moment of ^{176}Lu. J.Gerl, K.Ronge, K.Venkata Ramaniah, Th.W.Elze (Inst. fur Kernphys., Univ. Frankfurt, Frankfurt am Main, Germany), A.Hanser, L.D.Tolsma.
Z. Phys. A (Germany), vol.310, no.4, p.349-50 (1983).
The intrinsic quadrupole moment of ^{176}Lu has been determined by Coulomb excitation with α-particles to be 6.98 ± 0.10 b. Evidence for a new level at approximately 578 keV with presumably collective structure is presented. (7 refs.)

Structure of the excited states of the odd isotopes of bromine ^{75,77,79,81,83}Br ....See Entry 70428

The interacting boson model in the germanium region ....See Entry 70435

The interacting boson model applied to the mercury isotopes ..See Entry 70492

Strong enhancement of subbarrier fusion due to negative hexadecapole deformation ....See Entry 70637

21.10M Level density and structure

70452 Level structure of ^{106}Mo. K.Shizuma (Faculty of Engng., Hiroshima Univ., Hiroshima, Japan), H.Lawin, K.Sistemich.
Z. Phys. A (Germany), vol.311, no.1-2, p.71-8 (1983).
The level scheme of the very neutron rich nucleus $_{42}{}^{106}$Mo$_{64}$ has been studied for the first time through the β decay of ^{106}Nb. Six new excited states were observed in γ singles and γ-γ coincidence experiments in addition to the 2^+, 4^+ and 6^+ members of the ground state band. The excitation energies and the deexcitation pattern suggest the interpretation of the levels at 710, 885 and 956 keV as the $2_2{}^+$, $3_1{}^+$ and $0_2{}^+$ states, respectively. The data support the assumption of a non-axial deformation of ^{106}Mo. A half-life of (1.02 ± 0.05) s has been determined for the β decay of ^{106}Nb. (20 refs.)

70453 The 8^+ levels of ^{86}Zr revisited. C.A.Fields, F.W.N.de Boer (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Z. Phys. A (Germany), vol.311, no.1-2, p.127-30 (1983).
The 33 MeV ^{86}Sr(^{3}He, $3n\gamma$) reaction has been used to remeasure the level structure of the $N=46$ nucleus ^{86}Zr. The lowest 8^+ level is found at 3297.5 keV, consistent with some but not all earlier studies. On the basis of spectroscopic measurements and data-to-data comparisons with other $N=46$ nuclei, the 3531.8 keV level is also suggested as an 8^+. (11 refs.)

70454 Shell-model relationships between negative-parity states of even-mass $A=30$-40 nuclei. J.H.van der Merwe, R.Saayman (Dept. of Phys., Univ. of Stellenbosch, Stellenbosch, S Africa), A.J.van der Merwe.
Z. Phys. A (Germany), vol.311, no.3, p.225-41 (1983).
Simple relationships between the negative-parity energy level structures of the even-mass nuclei pairs $A=30$ and 32, 34 and 40, 34 and 36, 34 and 38, 40 and 38 are established along lines similar to the well-known Pandya transformation between the particle-hole spectrum of ^{40}K and the particle-particle spectrum of ^{38}Cl. The relationships are generated within the framework of the *jj*-coupling shell model, using standard Racah algebra, and no assumption is made about the physical nature of the nuclear two-body interaction. Candidates for the $1f_{7/2}$ and $2p_{3/2}$ multiplets are selected on the basis of their measured spectroscopic strengths in $l=3$ or 1 single-particle transfer reactions with due allowance for member fragmentation and mixing between the two configurations in terms of the calculation of spectroscopic-strength weighted centroids. The calculated correlated energy spectra are discussed with reference to the results of previous interaction-dependent shell-model calculations, especially those employing the modified surface delta interactions. Consideration is also given to uncertain or ambiguous spin and parity assignments, deduced two-body interaction matrix elements, and the isospin $T=0$ and 1 and single-particle $1f_{7/2}$ and $2p_{3/2}$ splittings. (39 refs.)

70455 Identification of levels in ^{24}Mg populated in the reaction ^{12}C(^{14}Nd,d)^{24}Mg. H.U.Gersch, E.Hentschel, F.Herrmann, H.Schobbert, D.Wohlfarth (Central Inst. of Nuclear Res., Rossendorf, Germany), W.Goldberg, M.Golowkow.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.56
The authors investigate the reaction ^{12}C(^{14}N,d)^{24}Mg(α)^{20}Ne to study the ^{12}C-transfer and the nuclear structure of ^{24}Mg. (5 refs.)

70456 Microscopic potential overlap for (^{7}Li,t) reactions. K.F.Pal, R.G.Lovas, T.Vertse (ATOMKI, Debrecen, Hungary).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.64
The reliability of (^{7}Li,t) reactions as spectroscopic tools depends on the goodness of the ^{7}Li wave functions used. This function enters into the DWBA amplitude through the potential overlap $\phi(r)=(7!/3!4!)^{1/2}<\Phi_\alpha\Phi_t|V_{\alpha-t}|\Phi_{Li}>_r$, where Φ are the (antisymmetrized) internal wave functions, $V_{\alpha-t}$ is the sum of the internucleon forces that act between the two fragments, and r is the distance of their c.m. The usual phenomenological approach postulates a local two-body force $U_{\alpha-t}(r)$ and replaces ϕ by $\phi_L(r)=U_{\alpha-t}(r)u(r)$, where u is the bound-state wave function in $U_{\alpha-t}$ of the proper quantum numbers and separation energy. The authors report their calculation of ϕ in the generator coordinate model (GCM) and its application to the ^{12}C(^{7}Li,t)^{16}O(0^+, 6.05 MeV) transition. (4 refs.)

70457 $\alpha+^{14}$C dinuclear molecular band in ^{18}O: a new perspective into heavy ion scattering resonant phenomena. M.Gai, M.Ruscev, A.C.Hayes, J.F.Ennis, R.Keddy, E.C.Schloemer, S.M.Sterbenz, D.A.Bromley (A.W. Wright Nuclear Structure Lab., Yale Univ., New Haven, CT, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.75
Transient nuclear molecules formed during heavy ion collisions are now proposed to exist throughout the periodic table, even in the case of U+U collisions. Such two body molecular state should be characterized by a dipole rather than a quadrupole degree of freedom as in the case of collective states in even-even nuclei. The ‘diatomic molecular band; based on such a dipole molecular state would have spin sequence, 0^+, 1^-, 2^+, 3^-, 4^+, ... and enhanced E1 transitions connecting these states. Recently, a molecular sum rule has been derived for the intensity of these transitions. That study also predicts enhanced E2 cross-over transitions which also would reflect the peculiar deformation of the molecular state. The authors have studied $\alpha+^{14}$C states in ^{18}O. Two different experiments: ^{14}C(^{7}Li,tγ)^{18}O coincidence measurements and ^{14}C(α,γ)^{18}O radiative capture studies were used to study all the decay modes of all states in ^{18}O up to 8.3 MeV in excitation. (4 refs.)

Electroexcitation of 2^+ and 4^+ states in ^{28}Si: a test of the renormalized shell model ....See Entry 70449

Decay properties of low-lying levels in ^{100}Rh ....See Entry 70490

Molecular resonances and spin alignment in ^{12}C+^{16}O inelastic scattering ....See Entry 70574

High resolution excitation function measurements and resonant structures in the ^{16}O-^{16}O-system at the Coulomb barrier ....See Entry 70621

21.30 NUCLEAR FORCES

(see also 13.75C Nucleon-nucleon interactions)

70458 Axial meson exchange current effects in deuterium in the current algebra approximation. J.Adam,Jr., E.Truhlik (Inst. of Nuclear Phys., Czechoslovak Acad. Sci., Rez, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.558-67 (1983).
The axial meson exchange current effects are studied in reactions of muon capture in deuterium and deuterium disintegration by the reactor antineutrinos. The exchange current operator is constructed using the weak production amplitude of the pion in the current algebra approximation. The results are compared with the hard pion method. (14 refs.)

70459 Meson-exchange Hamiltonian for *NN* scattering up to 1 GeV and Δ-nucleus dynamics. T.-S.H.Lee (Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1571-4 (16 May 1983).
A Hamiltonian for π, N, and Δ is constructed from meson-exchange mechanisms. The NN interaction in the model is directly derived from the Paris potential. Good fits to *pp* scattering data up to 1 GeV, including the ‘resonant’ $^1D_2$ and $^3F_3$ partial waves, have been obtained when a $\pi N\rightleftarrows\Delta$ interaction is introduced in a dynamical three-body approach. The model can be used for a many-body study of Δ-nucleus dynamics. (12 refs.)

70460 The quark model and the nucleon-nucleon interaction. A.Faessler, F.Fernandez (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.145-8 (28 April 1983).
The quark model and the resonating group method are used to calculate the nucleon-nucleon ^{3}S and ^{1}S phase shifts. The short range part of the N-N interaction is described by quark and gluons exchange between two three-quark clusters. For the long range part standard OBE (included only π and σ mesons) is used. The form factors of the OBE potential are calculated from the wave function of the three quark clusters using r-dependent quark-meson couplings. This ensures that the mesons couple to the quarks only on the surface region of the nucleons. The calculated phase shifts agree surprisingly well with the data. (13 refs.)

70461 The meson and quark-gluon degrees of freedom in NN-interaction at low and intermediate energies. A.N.Safronov (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.149-51 (28 April 1983).
A set of nonsingular integral equations has been formulated to calculate the partial amplitudes of hadron-hadron scattering at low and intermediate energies making allowance for the meson and quark-gluon degrees of freedom.

The results are presented of the calculations of the np effective range parameters and of the np scattering $^1S_0$- and $^3S_1$-phase shift at incident nucleon energies ranging from 1 to 1050 MeV. (9 refs.)

70462 **Nucleon recurrences in the cloudy bag model.** E.Umland, I.Duck (T.W. Bonner Nuclear Labs., Rice Univ., Houston, TX, USA).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.284-6 (5 May 1983).
The spectrum of nucleon recurrences in the 1-2 GeV region is analyzed in the context of the Cloudy Bag Model. The (1470) Roper resonance is required to be two $(1s)^2$ 2s three quark states split by ~100 MeV. The $P_{11}(1710)$ can be accommodated as a $(1s)^3$+TE gluon state. (17 refs.)

70463 **Potential pockets in the $^{238}U+^{238}U$ system and their possible consequences.** M.J.Rhoades-Brown (Phys. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), V.E.Oberacker, M.Seiwert, W.Greiner.
Z. Phys. A (Germany), vol.310, no.4, p.287-94 (1983).
Within the double-folding model the separation, shape, and orientation dependence of the interaction potential is studied for two heavy ions. An effective nucleon-nucleon interaction (M3Y) derived from *G*-matrix elements and based upon the Reid soft-core potential is used. Deformed Fermi-type matter densities with static quadrupole and hexadecapole deformations were utilized. The model is applied to the $^{238}U+^{238}U$ system and shows dramatic dependence on the deformations and orientations. (27 refs.)

On the axial charge and other static properties of the quark core in nucleons .... See Entry 70348

Vibrations of the atomic nucleus .... See Entry 70437

Anharmonic effects and pre-critical phenomena in pion condensation .... See Entry 70473

Flavour nuclei and one-boson-exchange potentials .... See Entry 70474

Bound states of negative pions and neutrons .... See Entry 70475

Variational calculation of nonuniform spin-ordered neutron matter including Δ isobar mixing .... See Entry 70479

On the nucleon optical potential in the one-boson exchange model .... See Entry 70523

Spreading width of Gamow-Teller resonances in ^{208}Bi .... See Entry 70526

21.40 FEW-NUCLEON SYSTEMS

Is the neutrino mass equal to 34 eV?—A discussion of the atomic effect in the β-decay of ^3H .... See Entry 70503

21.60 NUCLEAR-STRUCTURE MODELS AND METHODS

(for hadronic atoms and molecules, see 36.10)

70464 **On the neutron excess $(N-Z)$ and a periodic table for atomic nuclei.** A.Shima (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan).
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.49-57 (1983).
It is shown by equations that the proton numbers (or neutron numbers) where atomic nuclei become extremely stable, what are called magic numbers 2, 8, 20, 28, 50, ...(including comparatively stable numbers 6, 14, 40 etc.) can be expressed by two sequences of numbers. Also a periodic table for atomic nuclei where sequences of numbers are respectively put into one group as well as in the case of a periodic table of elements is presented. From the obtained table it is found that a definite rule exists between neutron excess $(N-Z)$ and Z, and a mathematical formulation for it is made. (11 refs.)

70465 **Single particle response in finite nuclei.** S.Shlomo (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.59
Simple expressions for the single-particle response (structure) function $S(E,q)$ and its sum rule, (Pauli blocking factor) $P(q)=\int dES(E,q)$, are derived in terms of the Wigner transforms (WTs) of the single-particle wave functions and the scattering probe $\sigma(\vec{q},\vec{r})$. Considering the WT as a quantum-mechanical analog of classical phase-space distribution function, these expressions have a simple phase-space interpretation. Using the Born approximation for $\sigma(\vec{q},\vec{r})$ and assuming independent nucleons in a harmonic oscillator potential well, simple analytic expressions are derived from $S(E,q)$ and $P(q)$. These results are compared with the well-known results for an infinite Fermi gas. (4 refs.)

On the axial charge and other static properties of the quark core in nucleons .... See Entry 70348

The meson and quark-gluon degrees of freedom in NN-interaction at low and intermediate energies .... See Entry 70461

Nucleon recurrences in the cloudy bag model .... See Entry 70462

Tensor component of the relativistic field in nuclear matter .... See Entry 70472

A simple determination of the nuclear surface symmetry energy .... See Entry 70476

Thermostatic properties of semi-infinite symmetric nuclear matter .... See Entry 70477

Low temperature expansions in a relativistic mean field approach .... See Entry 70478

Variational calculation of nonuniform spin-ordered neutron matter including Δ isobar mixing .... See Entry 70479

In-beam gamma-ray spectroscopy with heavy ions .... See Entry 70742

21.60C Shell model

70466 **Shell model basis of the interacting boson model.** I.Talmi (Weizmann Inst. of Sci., Rehovot, Israel).
Comments Nucl. & Part. Phys. (GB), vol.11, no.6, p.241-9 (1983).
The interacting boson model is related to shell model states constructed from pairs of identical valence nucleons coupled to $J=0$ and $J=2$. States of several such pairs with given generalized seniorities correspond to states of proton and neutron *s* and *d* boson states. The strong and attractive quadrupole interaction between protons and neutrons has large matrix elements between states constructed from such proton and neutron pairs (*S-D* space). Boson states which correspond to states in the *S-D* space can be used to diagonalize an equivalent boson Hamiltonian. In certain cases, states and operators of the proton and neutron *s*, *d* boson model (IBA-2) can be well approximated by the simpler version with one kind of *s* and *d* boson (IBA-1). (25 refs.)

Identification of single-particle configurations at very high spin in $^{150-152}Dy$ .... See Entry 70431

Centroids and widths in the symplectic collective model .... See Entry 70434

Shell model studies of very neutron deficient Ru and Rh nuclei .... See Entry 70440

Electroexcitation of 2^+ and 4^+ states in ^{28}Si: a test of the renormalized shell model .... See Entry 70449

Shell-model relationships between negative-parity states of even-mass $A=30-40$ nuclei .... See Entry 70454

Disproof of the alleged two-phonon character of the $0_2{}^+$ state in ^{64}Zn .... See Entry 70488

21.60E Collective models

70467 **A canonical coordinate system suitable for adiabatic treatment of collective motion: an illustrative model.** A.Kuriyama (Dept. of Phys., Kyushu Univ., Fukuoka, Japan), M.Yamamura.
Prog. Theor. Phys. (Japan), vol.69, no.2, p.681-4 (Feb. 1983).
With the aid of the canonicity condition, the authors specify a canonical coordinate system suitable for the adiabatic treatment of 'large' amplitude collective motion. They introduce a double transformation in order to specify a time-dependent Slater determinantal state. This specification follows that given by Baranger and Veneroni (1978). The utility of the canonicity condition is shown with the use of an illustrative model. (7 refs.)

70468 **The adiabatic approximation.** D.Brink (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England), G.Schutte.
Z. Phys. A (Germany), vol.310, no.4, p.307-15 (1983).
In large amplitude nuclear deformation the role of level crossings or pseudo-crossings of intrinsic levels is an outstanding problem. A model consisting of a harmonic oscillator as a collective part and a spin whose orientation energy depends on the collective coordinate is studied in order to clarify this problem. Especially the time-independent stationary state problem is discussed. Various perturbational expansions are presented and conditions for their convergence are given. The adiabatic approximation leading to a renormalization of the collective mass due to the level crossing is valid for vibrations with energies small compared to intrinsic energy differences. (13 refs.)

Investigation of the decay of oriented ^{145}Eu nuclei .... See Entry 70426

Structure of the excited states of the odd isotopes of bromine $^{75,77,79,81,83}Br$ .... See Entry 70428

Octupole states in the SO(6) limit .... See Entry 70430

U(6/12) supersymmetries in nuclei .... See Entry 70433

Centroids and widths in the symplectic collective model .... See Entry 70434

The interacting boson model in the germanium region .... See Entry 70435

Non local effects induced by the particle-vibration coupling .... See Entry 70439

Two-rotor model of deformed nuclei .... See Entry 70446

The parity violating rotation of the neutron spin in helium .... See Entry 70450

Microscopic potential overlap for $(^7Li,t)$ reactions .... See Entry 70456

Shell model basis of the interacting boson model .... See Entry 70466

Three limits in the interactions of the *s*, *d*, and *g* bosons .... See Entry 70469

The effective interaction between interacting bosons .... See Entry 70470

A microscopic approach to fluid dynamics of nuclear collective motions .... See Entry 70471

Anharmonic effects and pre-critical phenomena in pion condensation .... See Entry 70473

Study of nuclear transitions from aligned states using the example of octupole bands in actinides .... See Entry 70481

Disproof of the alleged two-phonon character of the $0_2{}^+$ state in ^{64}Zn .... See Entry 70488

The interacting boson model applied to the mercury isotopes .. See Entry 70492

Mass distributions of fission fragments emitted by highly excited nuclei .... See Entry 70633

21.60F Models based on group theory

70469 **Three limits in the interactions of the *s*, *d*, and *g* bosons.** Ling Yin-sheng (Jiangsu Teachers' Coll., China).
Chin. Phys. (USA), vol.3, no.1, p.86-100 (Jan.-March 1983). [received: May 1983]
In the IBM, when *s*, *d*, and *g* bosons are present, the boson Hamiltonian has the structure of group U(15). This paper deals with the various chains of subgroups of group U(15). Especially, the following chains: $SU(15)\supset SU(3)\supset SO(3)$, $SU(15)\supset SU(5)\supset SO(5)\supset SO(3)$, $U(15)\supset U(14)\supset SO(5)\supset SO(3)$ are studied in detail. The formulas of the energy spectra are also given. (8 refs.)

70470 **The effective interaction between interacting bosons.** Zhou Xiao-qian (Jiangsu Normal Coll., China).
Chin. Phys. (USA), vol.3, no.1, p.107-17 (Jan.-March 1983). [received: May 1983]
In the normal version of IBM, only the existence of the *p-p* boson and the *n-n* boson is assumed. Later on, Elliott and White attempted to consider the *p-n* boson and employed the isospin. The above-mentioned three kinds of bosons form an isospin triplet. They advocated that the effective Hamiltonian is isospin SU(2) invariant. In this article, the authors have the view that the Hamiltonian contains, besides the isoinvariant part, also a nonisoinvariant part. From the fact that IBM accounts for the low-lying levels of nuclei successfully, one can make some conclusion about the relations among the parameters occurring in the effective interaction. The original version of IBM and the Elliott-White theory are limiting cases of the present work. If IBM can also be applied to odd-odd nuclei, a special type of spectrum can be predicted. It seems that such kind of spectrum does appear in the experiments for a number of odd-odd nuclei. (9 refs.)

Octupole states in the SO(6) limit .... See Entry 70430

U(6/12) supersymmetries in nuclei .... See Entry 70433

Centroids and widths in the symplectic collective model .... See Entry 70434

The interacting boson model in the germanium region .... See Entry 70435

The quark model and the nucleon-nucleon interaction .... See Entry 70460

Shell model basis of the interacting boson model .... See Entry 70466

A canonical coordinate system suitable for adiabatic treatment of collective motion: an illustrative model .... See Entry 70467

Flavour nuclei and one-boson-exchange potentials ....See Entry 70474

Disproof of the alleged two-phonon character of the 0_2^+ state in ^{64}Zn ....See Entry 70488

The interacting boson model applied to the mercury isotopes ..See Entry 70492

About the unified description of elastic and inelastic cross sections in heavy-ion collisions ....See Entry 70521

21.60G Cluster models

Disproof of the alleged two-phonon character of the 0_2^+ state in ^{64}Zn ....See Entry 70488

Calculation of the cross section of the ^{6}Li(n,nd)^{4}He reaction with the cluster wave functions of the ^{6}Li nucleus ....See Entry 70546

Some problems in the microscopic theory for the interaction of complex nuclei ....See Entry 70559

21.60J Hartree-Fock and random-phase approximations

70471 A microscopic approach to fluid dynamics of nuclear collective motions. M.Di Toro (Theoretical Phys., Tech. Univ. of Munich, Garching, Germany), G.Giansiracusa, U.Lombardo.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.58
The fluid dynamics approach seems to be a powerful tool to understand collective motions in nuclei in terms of macroscopic quantities as local density, current and pressure tensor. The aim of this contribution is to show how it is possible to get fine results along this line without the need for big calculations. The starting point is the TDHF equation for the Wigner transform $f(\underline{r},\underline{p},t)$ of the one body density matrix. (5 refs.)

Study of nuclear transitions from aligned states using the example of octupole bands in actinides ....See Entry 70481

Collisional spreading of small amplitude nuclear vibrations ..... See Entry 70527

21.65 NUCLEAR MATTER

70472 Tensor component of the relativistic field in nuclear matter. M.Jaminon (Inst. of Phys., Univ. of Liege, Liege, Belgium).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.15, p.481-2 (9 April 1983).
In a relativistic description of nuclear matter, the most sophisticated microscopic calculations provide a relativistic potential which is the sum of only three well-defined Lorentz components a scalar (U_s), the time-like (U_0) and the spacelike (U_v) components of a vector. A Dirac equation which also includes a tensor component is discussed. (4 refs.)

70473 Anharmonic effects and pre-critical phenomena in pion condensation. M.C.Ruivo, C.A.Sousa, L.P.Brito (Dept. de Fisica, Univ. de Coimbra, Coimbra, Portugal).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.542-56 (Feb. 1983).
Pre-critical behaviour of neutron matter associated with pion condensation is investigated, in the framework of the generator coordinate method. The instability of the normal phase against charged and neutral condensation is described with Gaussian and harmonic approximation. The relevance of anharmonic corrections due to the Pauli principle is discussed, for the case of π^- condensation. (19 refs.)

70474 Flavour nuclei and one-boson-exchange potentials. H.Bando (Div. of Math. Phys., Fukui Univ., Fukui, Japan), S.Nagata.
Prog. Theor. Phys. (Japan), vol.69, no.2, p.557-64 (Feb. 1983).
Binding energies of a flavour baryon Λ (strange), Λ_c (charmed) and Λ_b (beauty), in nuclear matter and in the α-particle are investigated within the framework of the lowest-order Brueckner theory by employing the OBE potentials derived on the basis of the Nijmegen model *D* interaction. (15 refs.)

70475 Bound states of negative pions and neutrons. H.Garcilazo (Phys. Dept., Texas A&M Univ., College Station, TX, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1567-70 (16 May 1983).
By use of standard forms for the various interactions of a system of N neutrons and Z negative pions, it is shown that for a large variety of values of N and Z the system can become bound. This gives rise to a structure similar to that of an ordinary nucleus, but in which the protons are replaced by negative pions. (15 refs.)

70476 A simple determination of the nuclear surface symmetry energy. H.Krivine, J.Treiner (Div. de Phys. Theorique, Inst. de Phys. Nucleaire, Orsay, France).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.127-30 (28 April 1983).
Energy density formalism calculations in semi-infinite nuclear matter are performed. Using the Euler equations, one derives a simple and accurate expression for the surface-symmetry energy, which only involves, besides the surface properties of a symmetric semi-infinite medium, the symmetry energy in a uniform medium. (13 refs.)

70477 Thermostatic properties of semi-infinite symmetric nuclear matter. M.Barranco, M.Pi, X.Vinas (Facultad de Fisica, Univ. de Barcelona, Barcelona, Spain).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.131-4 (28 April 1983).
The thermal evolution of surface thickness and surface free energy of semi-infinite symmetric nuclear matter have been computed using a hot Thomas-Fermi model. Performing a leptodermous expansion of the total free energy, approximated analytical formulas for these quantities have been obtained. (11 refs.)

70478 Low temperature expansions in a relativistic mean field approach. A.Bouyssy, S.Marcos (Div. de Phys. Theorique, Inst. de Phys., Nucleaire, Orsay, France).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.139-44 (28 April 1983).
Starting from the relativistic mean field approach of Walecka (1981) which describes known properties of cold nuclear matter, finite temperature corrections and their low temperature expansions are calculated for the equation of state, the baryon effective mass, the bulk modulus and the symmetry energy coefficient. Simple analytical formulas are obtained and discussed as well as possible extensions of the model. (20 refs.)

70479 Variational calculation of nonuniform spin-ordered neutron matter including Δ isobar mixing. O.Benhar (Phys. Lab., Istituto Superiore di Sanita, Rome, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.305-8 (5 May 1983).
A modified two-nucleon interaction describing the effect of $\Delta(1236)$ isobar mixing into neutron states has been used in a Jastrow-like variational calculation of nonuniform spin-ordered neutron matter. The results indicate that, at a density larger than normal nuclear density by a factor 3-4, a transition to the inhomogeneous phase, associated with a neutral pion condensate, takes place. (20 refs.)

Exactly solvable model of a phase transition between hadronic and quark-gluon matter ....See Entry 70324

Thermodynamics of extended hadrons with baryon number .....See Entry 70342

The mean free path of protons in nuclei and the nuclear radius ....See Entry 70448

Noncompound light particle emission in nucleus-nucleus collisions ....See Entry 70566

21.80 HYPERNUCLEI

70480 Ξ hypernuclei. C.B.Dover (Brookhaven Nat. Lab., Upton, NY, USA), A.Gal.
Ann. Phys. (USA), vol.146, no.2, p.309-48 (1 April 1983).
The authors consider the possibility of forming doubly strange Ξ hypernuclei via the (K^-, K) reactions on various nuclear targets. Because of the high momentum transfer involved, even at 0°, the formation of high spin states is strongly favoured. The available experimental information on the elementary processes $K^-p \to K^+\Xi^-$ or $K^0\Xi^0$ is reviewed, leading to the determination of an optimum incident K^- momentum of about 1.9 GeV/c for the forward formation of discrete Ξ hypernuclear states. The cross section for the process $\Xi N \to \Lambda\Lambda$, responsible for the damping width of Ξ states in nuclei, is estimated theoretically and the very limited experimental data are also reviewed. The resulting Ξ hypernuclear widths are of order 5 MeV. Emulsion data which have been interpreted as due to the existence of $\Lambda\Lambda$ and Ξ^- hypernuclei are discussed and used to obtain an approximate Ξ nuclear well-depth of 21-24 MeV. For this range of values, spectra of single particle Ξ^- states are obtained, and calculated angular distributions for the formation of simple Ξ^- particle-proton hole states in ^{4}He, ^{12}C and ^{28}Si targets are presented. The peak 0° lab cross section at $p_{lab}=1.9$ GeV/c for such states ranges from tens of nb/sr to about 1 μb/sr. The authors briefly mention other methods for forming Ξ hypernuclei, such as the three body reaction $K^-N \to K\pi\Xi$ (or $K^-p \to K^+K^0\Omega^-$ for Ω^- hypernuclei). (41 refs.)

Flavour nuclei and one-boson-exchange potentials ....See Entry 70474

The role of the Y_1^* resonances in the $\bar{K}$-nucleus reactions at medium energies ....See Entry 70626

23.00 RADIOACTIVITY AND ELECTROMAGNETIC TRANSITIONS

(see also 82.55 Radiochemistry)

23.20 ELECTROMAGNETIC TRANSITIONS

70481 Study of nuclear transitions from aligned states using the example of octupole bands in actinides. I.N.Mikhailov, Ch.Brianson (Joint Inst. of Nuclear Res., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.12-22 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.849-59 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The negative-parity states of deformed nuclei can be schematically subdivided into octupole vibrational and two-quasi-particle bands. A high degree of collectivity of the $K^\pi=0^-$, 1^- and 2^- states was found in calculations performed according to the random-phase method. The effects of coupling with rotation have a strong influence on the properties of the vibrational states even at very moderate values of the total angular momentum I. The alignment of the vibrational angular momentum in negative-parity states of nuclei from the actinide region is manifested earlier than the alignment of the internal angular momenta associated with quasi-particle motion. At present a fairly rich experimental material including data on both the spectra and the decay properties of negative-parity states over a wide range of angular momenta has been accumulated, and this allows an attempt to be made at studying the principal regularities for nuclear transitions from aligned states. The authors solve this problem using a simple phenomenological model of the nucleus which allows much of the experimental data to be described. (20 refs.)

70482 γ-decay of the states of ^{55,56}Fe excited in the (n,xnγ) reaction on ^{56}Fe at $E_n=14.6$ MeV. S.Hlavac, P.Oblozinsky, R.Antalik (Phys. Inst., Acad. of Sci., Bratislava, Czechoslovakia).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.64-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.903-5 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The (n,xnγ) reaction at neutron energies of 14 to 15 MeV provides a good possibility for the investigation of various methods of the decay of excited states of nuclei. In order to study this reaction on ^{56}Fe (x=1 or 2) the authors created a unit which operated on a neutron beam. The theoretical calculations of the probability of transitions and of the average multiplicity of the γ-quanta were performed within the framework of the statistical model of nuclear reactions. They used a somewhat expanded STAPRE program which includes consideration of the preequilibrium emission of the first nucleon, realistic decay schemes and γ-radiation at all stages of the reaction. Standard parameters and the M. Kavai optical potential specially chosen for ^{56}Fe were used. The cross sections for 14 discrete transitions in the (n,n'γ) (n,2n) channels and the corresponding decay schemes are given. (4 refs.)

70483 Angular distributions of γ-quanta from the ^{93}Nb(n,n′γ) reaction. V.D.Avchukhov, K.A.Baskova, V.A.Bondarenko, A.B.Vovk, L.I.Govor, A.D.Demidov (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.111-15 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.947-51 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The spectrum of γ-quanta from the ^{93}Nb(n,n′γ) reaction was measured along with their angular distributions, the diagram of the levels was refined, and the angular momenta and mixtures of multipoles δ were determined. (20 refs.)

70484 Multiplicity of gamma-ray transitions in the reaction ^{160}Gd(^{16}O,xn)$^{176-x}$Hf. I. B.F.Petrov, V.V.Kamanin, J.Rudiger, S.P.Ivanova, O.E.Kraft, Yu.V.Naumov, V.V.Kobekov, V.A.Loshchenko (Sci. Res. Inst. of Phys., Leningrad State Univ., Leningrad, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.205-11 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1431-7 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The system of multiple integral equations that was described in detail by Petrov et al. (1980) is employed to investigate high-spin states populated in the ^{160}Gd(^{16}O,xn)$^{176-x}$Hf reaction. Measurements were conducted for ^{16}O energies from 5 to 9 MeV/nucleon. (11 refs.)

70485 Nuclear orientation of ^{147}Tb ($T_{1/2}$=1.7h), ^{149}Tb ($T_{1/2}$=4.15 h) and ^{151}Tb ($T_{1/2}$=17.7 h) in a gadolinium host. I.Prochazka, J.Konicek, M.Finger, A.Jankech, T.I.Kracikova, P.Simecek, V.M.Tsupko-Sitnikov (Joint Inst. for Nuclear Res., Dubna, USSR), W.D.Hamilton, J.Muhonen.
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.540-8 (1983).
Radioactive ^{147}Tb ($T_{1/2}$=1.7 h), ^{149}Tb ($T_{1/2}$=4.15 h) and ^{151}Tb ($T_{1/2}$=17.7 h) nuclei were oriented in a gadolinium host at low temperatures. Angular distributions of prominent gamma-rays were found to be isotropic within the experimental errors. This is consistent with the 1/2-spin assignments to all three parent states. (28 refs.)

70486 γ-radiation in the reaction ^{143}Nd (n,n′γ) using fast neutrons from a reactor. V.A.Bondarenko, I.L.Kuvaga, P.T.Prokof'ev.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.3-8 (1983). In Russian.
The γ-radiation spectrum in the reaction ^{143}Nd ($n,n'\gamma$) with the target of Nd_2O_3 enriched up to 83% ^{143}Nd has been measured at an angle of 90° to the neutron beam by a Ge(Li) detector. The energies and intensities of the 86 γ-transitions, which are placed in a scheme consisting of 37 levels, have been determined in the energy range from 90 to 2600 keV. The characteristics of the following levels are defined more exactly: 1228.29 ($13/2^+$), 1407-28 ($9/2^-$), 1431.49 ($11/2^-$), 1739.12 ($9/2^-$), 1851.96 ($7/2^-$, $9/2^-$), 1852.78 ($3/2^-$), 1910.74 ($5/2^-$), 1988.24 ($11/2^-$), 2011.49 ($7/2^-$), 2019.17 ($15/2^+$), 2075.39 ($11/2^+$), 2094.53 ($11/2^-$), 2135.17 ($7/2^-$), 2186.43 ($7/2^-$), 2197.31 ($11/2^-$), 2398.85 ($7/2^-$, $9/2^-$), 2483.42 ($11/2^+$, $13/2^+$) 2556.67 ($5/2^-$, $7/2^-$). Unplaced transitions suggest the existence of several unknown levels with I=5/2-9/2 in the energy interval from 2.5 to 3.0 MeV, which arise in the given reaction. (11 refs.)

70487 The γ-spectrum of ^{156}Gd from the inelastic scattering of fast neutrons. Ya.Ya.Berzin', T.V.Guseva, Yu.Ya.Tamberg.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.9-12 (1983). In Russian.
The γ-spectra of ^{156}Gd have been measured in the (n,n′γ) reaction of the reactor's fast neutron beam at energies ranging from 70 to 2900 keV. The 17 g Gd_2O_3 target enriched in ^{156}Gd to 95.5% has been used. The energies and intensities of 280 γ-transitions have been determined. (15 refs.)

70488 Disproof of the alleged two-phonon character of the $0_2{}^+$ state in ^{64}Zn. A.Passoja, J.Kantele, M.Luontama, J.Kumpulainen, R.Julin, P.O.Lipas, P.Toivonen (Dept. of Phys., Univ. of Jyvaskyla, Jyvaskyla, Finland).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.157-60 (28 April 1983).
A study of electromagnetic transitions from the $0_2{}^+$ and $0_3{}^+$ states in ^{64}Zn clearly shows that the quadrupole-phonon model is insufficient for this nucleus. All reported shell-model, cluster-vibration-model and advanced IBA calculations also fail to reproduce the decay branching ratios from the $0_2{}^+$ state. However, they are qualitatively explained by the O(6) limit of the IBA and fairly well quantitatively by a six-parameter IBA-1 fit. (24 refs.)

70489 Combined analysis of inelastic electron-scattering and muonic-atom hyperfine-splitting data: an application to ^{152}Sm. W.Reuter, E.B.Shera, H.D.Wohlfahrt (Los Alamos Nat. Lab., Los Alamos, NM, USA), Y.Tanaka.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.293-6 (5 May 1983).
Explores a method for combined analysis of inelastic electron-scattering data and muonic quadrupole hyperfine-splitting measurements. The method, applied here to ^{152}Sm, provides an accurate normalization for (e,e′) data, a precise value for $B(E2;0^+\rightarrow 2^+)$, and shows that the interpretation of the monopole (elastic) and quadrupole (inelastic) data from both experiments is consistent at the present level of experimental accuracy. (14 refs.)

70490 Decay properties of low-lying levels in ^{100}Rh. A.M.Bizzeti Sona, P.Blasi, P.A.Mando' (Istituto di Fisica, Univ. di Firenze, Firenze, Italy).
Z. Phys. A (Germany), vol.311, no.3, p.163-71 (1983).
Low-lying levels of ^{100}Rh have been investigated with the reaction ^{100}Ru($p,n\gamma$)^{100}Rh in the proton energy range 4.4 MeV$\leq E_p \leq$6 MeV. A level scheme including 18 previously unreported excited levels has been deduced on the basis of singles γ-spectra and extensive γ-γ coincidence measurements. The γ branchings of several levels have also been measured. By means of the pulsed beam technique, the mean lifetimes of the excited states at 151.18, 160.7, 329.4 and 389.7 keV have been determined as $\tau_m=(1.4\pm0.2)$ns, (5.7 ± 0.3) ns, (1.1 ± 0.4) ns and (0.9 ± 0.4) ns, respectively. The lifetimes of the levels at 32.7 keV and 74.8 keV have been found to be $\tau_m=(36.5\pm4.5)$ ns and (312.5 ± 7.5) ns, in good agreement with recently reported values. An upper limit of 0.5 ns has also been placed for the lifetimes of eleven other levels. (19 refs.)

70491 A probabilistic model for spectral assignment in the (n,γ) reaction. M.A.Islam, T.J.Kennett, W.V.Prestwich (Dept. of Phys., McMaster Univ., Hamilton, Ontario, Canada).
Z. Phys. A (Germany), vol.311, no.3, p.195-204 (1983).
A method has been developed to aid in determining if a particular transition in an (n,γ) reaction originated from the compound, rather than from an intermediate, state. The method is based upon a simple model which is demonstrated to be tolerant to sizeable variations in the nuclear parameters employed. The reliability of the procedure is assessed by comparing the predictions of the model with results gained through detailed analysis by others. Finally the technique is applied to some recently acquired data in order to illustrate how much information can be extracted by its use. (15 refs.)

70492 The interacting boson model applied to the mercury isotopes. A.F.Barfield, B.R.Barrett, K.A.Sage, P.D.Duval (Dept. of Phys., Univ. of Arizona, Tucson, AZ, USA).
Z. Phys. A (Germany), vol.311, no.3, p.205-15 (1983).
The even isotopes of mercury have been systematically studied using the Interacting Boson Model (IBM). In order to treat shape coexistence in the light isotopes, two separate IBM calculations were performed with different configurations, which were subsequently mixed. The four Hamiltonian parameters, which were allowed to vary freely from isotope to isotope, were found to be consistent with the corresponding IBM parameters used for platinum and osmium. Overall, the calculated energy spectra and electromagnetic properties are in reasonable agreement with experiment. (41 refs.)

Heavy ion collisions. Vol.3 .... See Entry 69804

Investigation of the decay of oriented ^{145}Eu nuclei .... See Entry 70426

Investigation of the decay of oriented ^{147}Eu nuclei .... See Entry 70427

Excitation of the collective states of nuclei of the transitional region having A≈190 to 200 for inelastic scattering of low-energy neutrons .... See Entry 70429

Octupole states in the SO(6) limit .... See Entry 70430

Identification of single-particle configurations at very high spin in $^{150-152}$Dy .... See Entry 70431

Yrast-Yrare interaction in Os nuclei .... See Entry 70432

The interacting boson model in the germanium region .... See Entry 70435

Shell-model relationships between negative-parity states of even-mass A=30-40 nuclei .... See Entry 70454

$\alpha+^{14}$C dinuclear molecular band in ^{18}O: a new perspective into heavy ion scattering resonant phenomena .... See Entry 70457

The adiabatic approximation .... See Entry 70468

Investigation of the decay of ^{165}Tm$\rightarrow^{165}$Er .... See Entry 70500

The 1^-(1.9 MeV β^-)2^+ transition in the decay of ^{148}Pm .... See Entry 70505

^{164}Ta, identification of a new isotope .... See Entry 70506

Statistical properties of $3/2^+$ resonances in ^{49}V .... See Entry 70528

Gamma-ray polarization and nuclear orientation measurements on ^{182}TaFe .... See Entry 70541

In-beam gamma-ray spectroscopy with heavy ions .... See Entry 70742

23.20C Lifetimes and transition probabilities

Shell model studies of very neutron deficient Ru and Rh nuclei .... See Entry 70440

γ-decay of the states of ^{55,56}Fe excited in the (n,xnγ) reaction on ^{56}Fe at E_n=14.6 MeV .... See Entry 70482

Decay properties of low-lying levels in ^{100}Rh .... See Entry 70490

23.20N Internal conversion and extranuclear effects

Investigation of the decay of ^{165}Tm$\rightarrow^{165}$Er .... See Entry 70500

23.40 BETA DECAY; ELECTRON AND MUON CAPTURE

70493 Double beta decay, massive neutrinos and lepton conservation. S.P.Rosen (Nat. Sci. Foundation, Washington, DC, USA).
AIP Conf. Proc. (USA), no.96, p.352-73 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
The phenomenon of double beta decay is reviewed and its implications for neutrino properties such as mass, right-handed currents and Majorana self-conjugacy are described. At present the only indication that the lepton number violating no-neutrino mode occurs is an indirect one based upon a comparison of ^{128}Te and ^{130}Te lifetimes. This history and latest status of this argument are discussed. Should the no-neutrino mode be observed, a whole program of experiments will be needed to determine the mechanism responsible for it. (41 refs.)

70494 Double beta decay—an experimental review. Chien-Shiung Wu (Columbia Univ., New York, NY, USA).
AIP Conf. Proc. (USA), no.96, p.374-95 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
In this review, a brief discussion on the experimental objectives and theoretical conceptions of the neutrinos was introduced. Two different types of experimental methods and their results were presented and discussed. (29 refs.)

70495 Geochemical double beta decay experiments. T.Kirsten (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
AIP Conf. Proc. (USA), no.96, p.396-410 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
Double Beta Decay provides a very sensitive test of lepton-number conservation. However, decay rates are so small that it has not yet been possible to unequivocally detect a Double Beta Decay event directly; so much the more important is the data obtained by the 'geochemical' method where one detects the Double Beta Decay products which have accumulated in natural minerals during long geological time periods. In that order, the author discusses the principles of the geochemical method, its strength and its limitations, the available data, new results on the ^{128}Te-^{130}Te system and the theoretical implications of the data concerning the electron neutrino restmass and lepton-number conservation. A limit of $m_\nu\leq$5.6 eV (95% confidence) has been obtained from our recent ^{128}Te-^{130}Te-measurements. (34 refs.)

70496 The Irvine ^{82}Se experiments. M.K.Moe, A.A.Hahn (Univ. of California, Irvine, CA, USA).
AIP Conf. Proc. (USA), no.96, p.411-18 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
The large difference in half lives implied for ^{82}Se by a cloud chamber experiment and by geochemical methods remains unresolved. The need for a definitive direct counting measurement of the 2ν double beta decay half-life, and the great interest in searching for Oν decay, have motivated the construction of a new TPC experiment sensitive to both modes. The cloud chamber and TPC experiments are briefly described. (6 refs.)

70497 Early results from the Battelle-Carolina ^{76}Ge double beta decay project. F.T.Avignone,III (Dept. of Phys., Univ. of South Carolina, Columbia, SC, USA), R.L.Brodzinski, D.P.Brown, J.C.Evans,Jr., W.K.Hensley, J.H.Reeves, N.A.Wogman.

AIP Conf. Proc. (USA), no.96, p.419-26 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).

A search for no-neutrino double beta decay of ^{76}Ge using an anticoincidence shielded Ga spectrometer is reported. A new lower limit of $T_{1/2} \geq 1.7 \times 10^{22}$ y at a 90% CL was determined using a maximum likelihood analysis on a 5 keV wide energy bin centered at 2041 keV. Combining this result with the shell model calculations of Haxton, Stephenson and Strottman, the authors obtain $\bar{m}_\nu \leq 10$ eV and $|\eta| \leq 2.4 \times 10^{-5}$. (9 refs.)

70498 The status of the UCSB-LBL ^{76}Ge double beta decay experiment. M.S.Witherell (Univ. of California, Santa Barbara, CA, USA).

AIP Conf. Proc. (USA), no.96, p.427-9 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).

The author describes an experiment to look for neutrinoless double beta decay in ^{76}Ge which is now under construction. Eight large high-purity germanium detectors are surrounded by an active shield of sodium iodide. The problem of reducing background sources is discussed in some detail. (1 ref.)

70499 Recent results obtained in the Mt. Blanc experiment on $\beta\beta$ decay of ^{76}Ge. E.Bellotti, E.Fiorini, C.Liguori, A.Pullia, A.Sarracino, L.Zanotti (Dipartimento di Fisica, Univ. di Milano, Milano, Italy).

AIP Conf. Proc. (USA), no.96, p.430-3 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).

Results are reported of a search for double beta decay of ^{76}Ge. The experimental set-up has been running under Mt. Blanc ($\sim$5000 m w.e. depth) for 3000 hours. No evidence appears for either $0^+ \rightarrow 0^+$ or $0^+ \rightarrow 2^+$ neutrinoless transitions with half lifetime limits of $1.1.10^{22}$ and $4.2.10^{21}$ years, respectively, at 90% c.l. (9 refs.)

70500 Investigation of the decay of ^{165}Tm$\rightarrow$^{165}Er. Ts.Vylov, V.M.Gorozhankin, K.Ya.Gromov, V.V.Kuznetsov (Joint Inst. of Nuclear Res., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.1-11 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.834-48 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).

Gives the results of new measurements of the spectra of positrons, γ-rays, internal-conversion electrons and eγ-coincidences during thes decay of ^{165}Tm. The properties of the bands and states of ^{165}Er are also given. (22 refs.)

70501 Polarization effects of currents of the second kind during β^--decay. I.Kumar, N.V.Samsonenko (P. Lumumba Internat. Friendship Univ., Moscow, USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.83-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.921-4 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).

Investigates the polarisation effects caused by currents of the second kind during β-decay assuming the principle mechanism is the β^--decay of a neutron. Relativistic corrections which take account of the dependence on the velocity of the final nucleon are derived. These results are useful in the discussion of whether terms containing currents of the second kind are present in the weak interaction hamiltonians. (9 refs.)

70502 Investigation of K X-rays which accompany the decay of ^{168}Tm$\rightarrow$^{168}Er. V.A.Sergienko, A.V.Vorontsovskii, Ya.A.Golovin.

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.108-10 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.944-6 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).

The relative intensities of the K-series X-ray lines are determined along with the relative probability of K-capture to the 1541.5 keV level of ^{168}Er. (13 refs.)

70503 Is the neutrino mass equal to 34 eV?—A discussion of the atomic effect in the β-decay of ^{3}H. Ching Cheng-rui, Ho Tso-hsiu (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China).

Commun. Theor. Phys. (China), vol.1, no.1, p.11-18 (1982).

In evaluating the β-spectrum of atomic ^{3}H a more accurate formula is obtained, in which the first three transitions leading to the lowest three states of ^{3}He$^+$ are treated exactly, and the closure approximation is used to estimate the contribution from all excited states with $n > 3$. (9 refs.)

70504 Double beta decay. M.Doi (Inst. of Phys., Osaka Univ., Toyonaka, Japan), T.Kotani, H.Nishiura, E.Takasugi.

Prog. Theor. Phys. (Japan), vol.69, no.2, p.602-35 (Feb. 1983).

The double β decay is investigated by the use of the relativistic Coulomb wave function including the finite nuclear size effect. A general form of the $V \pm A$ interactions is considered. It is shown that the decay rate is enhanced considerably in comparison with the case of the plane wave multiplied by the non-relativistic Fermi factor. It is confirmed that the selection rule derived on the basis of the plane wave is still valid in the relativistic Coulomb wave case. The neutrino mass and the $V+A$ current parameters are estimated from the analysis of experimental data. (48 refs.)

70505 The 1^-(1.9 MeV β^-)2^+ transition in the decay of ^{148}Pm. O.A.Rosso (Dept. de Fisica, Univ. Nacional de La Plata, La Plata, Argentina), L.Szybisz.

Z. Phys. A (Germany), vol.311, no.1-2, p.119-26 (1983).

The non-unique first-forbidden 1^-(1.9 MeV β^-)2^+ transition in the decay of ^{148}Pm is studied. The nuclear matrix elements are evaluated using for the ground state of the odd-odd ^{148}Pm a phenomenological wave function derived by Szybisz (1975) in the framework of the two-quasiparticle model and assuming that the first excited 2^+ state in ^{148}Sm can be described as the first quadrupole phonon state. This model provides nuclear matrix elements which are capable of describing experimental data like the spectrum shape factor, the longitudinal polarization of the electrons and a particular set of β-γ directional correlation coefficients, but it fails to interpret the large log *ft* value of this transition. In addition, the validity of the ξ-approximation is discussed. (37 refs.)

Investigation of the decay of oriented ^{145}Eu nuclei ....See Entry 70426

Investigation of the decay of oriented ^{147}Eu nuclei ....See Entry 70427

Level structure of ^{106}Mo ....See Entry 70452

Gamma-ray polarization and nuclear orientation measurements on ^{182}TaFe ....See Entry 70541

Fission yields of In isotopes in the thermal neutron fission of ^{235}U ....See Entry 70634

Autoionisation of the higher shells of an atom during β-decay ....See Entry 70826

23.60 ALPHA DECAY

70506 ^{164}Ta, identification of a new isotope. U.J.Schrewe, E.Hagberg, H.Schmeing, J.C.Hardy, V.T.Koslowsky, K.S.Sharma (Chalk River Nuclear Lab., AECL, Chalk River, Ontario, Canada).

Z. Phys. A (Germany), vol.310, no.4, p.295-300 (1983).

The new isotope ^{164}Ta ($T_{1/2}$=13.6(2)s) was produced in the ^{127}I(^{40}Ca,3n) reaction and transported to a measuring station by helium jet. Decay properties were observed with α, γ, and γ-γ spectroscopy. The Z assignment of the new isotope was based on γ-X-ray coincidence measurements. The mass assignment was deduced from measured excitation functions. The two γ rays assigned to the new activity most likely originate from the $4^+ \rightarrow 2^+ \rightarrow 0^+$ decay sequence in ^{164}Hf. A small α branch, $\leq$0.016(5)%, with an α decay energy of E_α=4625(15)keV was found and assigned to the decay of ^{164}Ta. The deduced upper limit of the α width for this branch, $W_\alpha \leq 0.6(2)$, is in accordance with those known for neighbouring nuclei. (17 refs.)

Shadowing of α-emitting fragments observed in 313 MeV ^{32}S+^{93}Nb collisions ....See Entry 70575

Spontaneous fission half-life of ^{242}Cm ....See Entry 70632

Observation of radiative capture in the reaction ^{90}Zr+^{90}Zr ....See Entry 70641

23.90 OTHER TOPICS IN NUCLEAR DECAY AND RADIOACTIVITY

70507 Identification of the proton drip line. G.D.Alkhazov, K.A.Mezilev, Yu.N.Novikov, A.M.Nurmukhamedov (Leningrad Nuclear Phys. Inst., Acad. of Sci., Gatchina, Leningrad, USSR), N.Ganbaatar, K.Ya.Gromov, V.G.Kalinnikov, A.Potempa, F.Tarkanyi.

Z. Phys. A (Germany), vol.311, no.3, p.245-6 (1983).

A group of proton emitters of Au, Ir, Re, Ta has been identified by means of mass values derived from the experimental data. The proton drip line has been determined. It is shown that on the boundary of the proton stability the values of proton pairing energies increase by about 50% as compared with the isotone nuclei near the beta-stability line. (8 refs.)

24.00 NUCLEAR REACTIONS AND SCATTERING: GENERAL

24.10 NUCLEAR REACTION AND SCATTERING MODELS AND METHODS

70508 Coulomb effects in the multichannel K-matrix approach to the theory of nuclear reactions. L.D.Blokhintsev, A.N.Safronov (Sci. Res. Inst. of Nuclear Phys., M.V. Lomonosov Moscow State Univ., Moscow, USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.88-93 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.925-30 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).

A method is considered for taking account of the Coulomb effects within the framework of the multichannel K-matrix approach to the theory of nuclear reactions. The authors give a dispersion-theory treatment of the K-matrix formalism, and on this basis, using the analytic properties of the Coulomb-nuclear amplitudes, they formulate an equation that couples the T- and K-matrices. In the potential scattering problem this equation may be rigorously substantiated, and a nonsingular integral equation may be derived for the K-matrix. The indicated equation may be treated as a generalisation of the well-known Heitler equation (1967) for the case when there is Coulomb interaction between particles. (13 refs.)

70509 Laplace transform method for off-shell scattering on nonlocal potentials. D.K.Ghosh, S.Saha, K.Niyogi, B.Talukdar (Dept. of Phys., Visva-Bharati, West Bengal, India).

Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.528-39 (1983).

A Laplace transform method is developed to construct off-shell wave functions for scattering on nonlocal potentials. Specific results presented refer to some symmetric and nonsymmetric potentials which have important applications in nuclear scattering reactions. It is pointed out that the merit of the present approach is its simplicity. (12 refs.)

70510 A coupled channel computing code for neutron-nucleus reactions. Yan Bai-ling (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).

Commun. Theor. Phys. (China), vol.1, no.1, p.97-106 (1982).

A method of calculating the coupled channel Schrodinger equations is described and the structure of the computing code is given. (7 refs.)

70511 The non-orthogonality problem of the coupled reaction channels method. E.W.Schmid (Inst. fur Theoretische Phys., Univ. der Tubingen, Tubingen, Germany).

Z. Phys. A (Germany), vol.311, no.1-2, p.67-70 (1983).

The coupled reaction channels method is formulated as a two-step procedure. In the first step, the eigenvalue problem of the overlap operator is solved. In the second step, an off-shell transformation is applied to the coupled reaction channels equation. The transformed equation has an energy-independent interaction. Redundant solutions which arise when the test function space is linearly dependent are removed from the physical part of the spectrum and become positive energy bound states at chosen (unphysical) energies. The non-orthogonality of test functions of different channels is related to the appearance of implicit distortion corrections. (11 refs.)

70512 Solution of the reduced occupation-number equation for a fermion system. Z.Jingshang, G.Wolschin (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).

Z. Phys. A (Germany), vol.311, no.3, p.177-84 (1983).

The relaxation of the single-particle occupation numbers towards the equilibrium limit in a fermion system is studied on the basis of a nonlinear transport equation. The solution is obtained numerically for time-dependent transport coefficients, and compared with the analytical results for constant coefficients. In both cases the time-dependence of the entropy is discussed. (5 refs.)

70513 Multiparticle production in hardon-nucleus and nucleus-nucleus collision. V.Kumar (Dept. of Phys., Univ. of Rajasthan, Jaipur, India).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.7
Successive independent collision and collective collision approaches for understanding the mechanism of multiparticle production have been reviewed in the light of normalized mean multiplicity of created particles (R_3) and its target mass dependence, dispersion to averaged created particle multiplicity relation and dispersion of rapidity of shower particles, etc. The two approaches have also been tested for the single traversal of projectile hadron through target at a given impact. This has been done by using differential shower multiplicity distributions corresponding to grey particle (recoiled protons) bins in the emulsion experiments. The experimental world data of p-A and π^--A reactions does not support either of the two approaches completely. Average multiplicity of charged pions in p-A, π^--A, and nucleus-nucleus collisions shows a polynomial growth with energy available in centre of mass system. (no refs.)

70514 Study of three particle correlation in relativistic heavy ion collision. D.Ghosh (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.9
To obtain information on the mechanism of heavy ion interactions it is important to investigate the correlation effects among the relativistic particles produced. Although there have been some studies on 2-particle correlation no work has yet been reported where an investigation of 'true' three particle correlation of dynamical origin has been done. The author makes a first investigation for the 'true' three particle dynamical correlation among relativistic particles produced in the interaction of O^{16} with nuclei of photoemulsion at 2.1 GeV/n. (1 ref.)

70515 Equilibrium and nonequilibrium sequential emission of light particles in deeply inelastic collision (DIC). A.Strazzeri (Istituto di Fisica, Univ. Dicatania, Catania, Italy).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.34
Simple theoretical expressions are presented for the preequilibrium (PE) and equilibrium (E) parts of the b-c angular correlation for a sequential three-body reaction X(a,b)Y(c)Z under the hypothesis that the nucleus Y is excited to levels that lie within an energy interval Δ centred at ϵ^*. (1 ref.)

70516 Consequences of multiple interactions mechanism for particle production on nuclei in kinematically forbidden region. V.B.Kopeliovich (Inst. for Nuclear Res., Moscow, USSR).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.35
The consequences of multiple interactions mechanism for particle production on nuclei in the region kinematically forbidden for interaction with an isolated nucleon (KFR), or cumulative production, are considered. (no refs.)

70517 The breakup of spectator residues in relativistic nuclear collisions. A.I.Warwick, H.H.Gutbrod, H.G.Ritter, H.Stelzer, F.Weik, H.H.Wieman, S.B.Kaufman, E.P.Steinberg, B.D.Wilkins (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.37
Based on the results of a multi-detector experiment, the authors develop a comprehensive description of the breakup of the excited residue of a Au nucleus after bombardment by relativistic protons, helium and neon projectiles. They have measured the spectra of the slow fragments ($10<A<150$) and the multiplicities of the charged particles emitted from the same event. These multiplicities fall into two categories; the fast, light particles from the primary interaction zone and the slower, heavier charged particles ($2<Z<12$) from the target residue. They separate the contribution of fission to the yield of intermediate mass fragments from a more violent spallation mechanism, which produces fragments across the full range of measured masses. (3 refs.)

70518 Selection of binary and nonbinary heavy ion reactions via particle KX-ray coincidences. H.W.Wilschut, R.K.Bhowmik, P.B.Goldhoorn, J.F.W.Jansen, R.H.Siemssen, K.Siwek-Wilczynska, Z.Sujkowski, J.Wilczynski (Kernfysisch Versneller Inst., Groningen, Netherlands).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.46
The authors have developed a new method for selecting and studying various channels of heavy-ion reactions in strongly asymmetric systems. The method consists of detection of double (particle-KX_1) and triple (particle-KX_1-KX_2) coincidences between fast projectile residues and KX-rays resulting from converted transitions in complementary heavy reaction products. By identifying the ejectile (Z and A) with a standard ΔE-E telescope and the charge of the heavy nucleus one can determine the primary reaction channel, assuming that reactions involving 4 particles in the final state do not contribute significantly. In such a way, the reaction sub-channels (projectile, ejectile XN) which can be identified in the particle-γ coincidence method are integrated in a common yield corresponding to a given $Z_{residue}$. (2 refs.)

70519 Two particle−two hole effects on the mass distributions in deep inelastic heavy ion collisions. M.Tohyama, S.Yamaji (Cyclotron Lab., Inst. of Phys. & Chem. Res., Saitama, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.49 (3 refs.)

70520 The nuclear response and the imaginary potential for nucleus-nucleus collision. S.C.Phatak (Inst. of Phys., Bhubaneswar, India), B.Sinha.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.60 (2 refs.)

70521 About the unified description of elastic and inelastic cross sections in heavy-ion collisions. A.A.Shirokova, K.V.Shitikova (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.61
The approach permitting a unified description of elastic and inelastic cross section with excitation of a monopole resonance in heavy-ion collisions is proposed and developed. In the K-harmonic method, the densities for the ground and monopole-excited states of nuclei can be obtained in a unified manner and are different solutions for the same equation. (2 refs.)

70522 Methods for the microscopic calculation of the potential overlap in the DWBA description of multiparticle transfer reactions. R.G.Lovas, K.F.Pal (ATOMKI, Debrecen, Hungary), M.A.Nagarajan.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.62
The DWBA amplitude of the A(a,b)B(a=b+x) process involves the potential overlap $\phi(r)=(a!/b!x!)^{1/2}<\Phi_b\Phi_x|V_{b-x}|\Phi_a>$ r, where Φ are antisymmetrized internal wave functions and V_{b-x} is the sum of internucleon forces between b and x. A best means of determining ϕ is from the generator coordinate model (GCM) for a, in which the trial function is schematically $\Psi_a=\int dSS^2f^0(S)\mathcal{A}_{b-x}\{\Psi_b\Psi_x\}_S$+distortion terms, where Ψ_b and Ψ_x, which are c.m. factors times Φ_b and Φ_x respectively, are pinned down at the distance of S from each other, $\mathcal{A}_{b-x}$ is the intercluster antisymmetrizer, and $f^0(S)$ is the GCM amplitude determined by diagonalizing the Hamiltonian. In general, it is difficult to compute ϕ because of its asymmetric form. The authors have elaborated two exact procedures and two approximate methods for evaluating the DWBA amplitude. As a test, they applied them to the non-trivial and realistic example of a ^7Li composed purely of free α and t clusters of equal size represented by harmonic oscillator wave functions. (3 refs.)

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received) ....See Entry 69785

Equivalent local potentials and Perey factors for various kinds of relative wave functions of RGM. I. Formulation ....See Entry 69928

High energy scattering theory of many-particle system ....See Entry 69937

The interacting boson model in the germanium region ....See Entry 70435

Evidence for 3p-2h rotational bands in ^{17}O ....See Entry 70436

Study of spin-orbit interaction of ^{13}C and ^{15}N nuclei in ^{14}C induced transfer reactions on ^{138}Ba ....See Entry 70438

Axial meson exchange current effects in deuterium in the current algebra approximation ....See Entry 70458

A probabilistic model for spectral assignment in the (n,γ) reaction ....See Entry 70491

Spreading width of Gamow-Teller resonances in ^{208}Bi ....See Entry 70526

Investigation of the mechanism of the $(^3He,\alpha)$ reaction of the ^{13}C nucleus ....See Entry 70530

On the polarisation and interference phenomena in the process of electrospallation of a deuteron ....See Entry 70531

The nuclear response time in precompound reactions ....See Entry 70534

Structure of the mass operator in finite Fermi systems ....See Entry 70540

The theory of electron-scattering coincidence experiments ....See Entry 70544

Electron scattering from ^{13}C ....See Entry 70545

Calculation of the cross section of the $^6Li(n,nd)^4He$ reaction with the cluster wave functions of the ^6Li nucleus ....See Entry 70546

Estimate of the error of solving the integral equation with the local potential for scattering of a nucleon by a deuteron ....See Entry 70547

The proton-deuteron scattering lengths ....See Entry 70551

Carbon and deuterium nuclear scattering of 48.5 MeV protons ....See Entry 70553

On the spin-dependence of transfer channel coupling in sub-coulomb deuteron scattering ....See Entry 70556

Elastic scattering of high energy alpha-particles on nuclei ....See Entry 70557

***D*-state and multistep effects in (α,d) reactions** ....See Entry 70558

Some problems in the microscopic theory for the interaction of complex nuclei ....See Entry 70559

Interaction of relativistic alpha particles in emulsion at 2.1 GeV/c/nucleon ....See Entry 70560

Formation of the mass and angular distributions of the products of reactions with heavy ions ....See Entry 70564

Light fragment emission in the model of transport theory for high-energy nucleus-nucleus collisions ....See Entry 70569

Single nucleon transfer reactions in a core excitation model for ^{48}Ti incident on ^{42}Ca at 8 MeV/amu ....See Entry 70572

Molecular resonances and spin alignment in $^{12}C+^{16}O$ inelastic scattering ....See Entry 70574

Coulomb nuclear interference effects in the elastic and inelastic scattering of ^{16}O and ^{18}O ions on ^{70}Ge ....See Entry 70577

On the energy-distribution of diabatically emitted neutrons in heavy-ion collisions ....See Entry 70599

Some systematics of total inclusive neutron cross sections for relativistic neon ions ....See Entry 70600

Light charged particle emission in 84 MeV/u C induced reactions on Ni. A comparison with an intranuclear cascade model ....See Entry 70603

Low energy particles produced in heavy ion reactions ....See Entry 70605

Dynamical coupling of relative motion, deformations and charge transfer in deep inelastic heavy-ion collisions ....See Entry 70610

Effects of the mass fragmentation potential on the mass diffusion phenomena ....See Entry 70613

Macroscopic and microscopic features of ^6Li-light nucleus scattering potentials at $E_{Li}=156$ MeV ....See Entry 70615

Energy dependence of heavy target fragmentation in nucleus-nucleus collisions ....See Entry 70624

Galileo-invariant theory of low energy pion-nucleus scattering. I. Impulse approximation and Fermi motion ....See Entry 70625

The role of the Y_1^* resonances in the $\bar{K}$-nucleus reactions at medium energies ....See Entry 70626

Further evidence for the EELL effect ....See Entry 70627

24.10H Optical and diffraction models

70523 On the nucleon optical potential in the one-boson exchange model. A.V.Pozdnyakov, L.N.Savushkin, V.T.Ippolitov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.38-40 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.874-6 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The authors construct the entire real part of the optical potential by starting from the NN-interaction in the one-boson exchange model. This potential is then used in calculations of neutron cross sections. (4 refs.)

70524 A phenomenological imaginary part of the optical potential for heavy ions. J.M.Quesada, M.Lozano, G.Madurga (Dept. de Fisica Atomica y Nuclear, Facultad de Fisica, Univ. de Sevilla, Sevilla, Spain).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.14-18 (19 May 1983).
The depth of the imaginary part of the optical potential is derived from the assumption that, at a given energy and for each partial wave L, it is proportional to the compound nucleus density level up to a given excitation energy above the yrast level corresponding to the angular momentum *L*, and remains a constant for smaller values of *L*. The prescription is successfully tested for the system ^{16}O+^{28}Si at nine different projectile energies between 33 and 81 MeV; it fails however at 141.5 MeV, as expected, because other channels, besides elastic scattering and fusion, are important. (18 refs.)

Deformation correlation effects in the ^{154}Sm-^{144}Sm neutron density difference .... See Entry 70447

Potential pockets in the ^{238}U+^{238}U system and their possible consequences .... See Entry 70463

Bound states of negative pions and neutrons .... See Entry 70475

Impulse-approximation Dirac optical potential .... See Entry 70549

Relativistic impulse approximation for *p*-nucleus elastic scattering .... See Entry 70550

On the spin-dependence of transfer channel coupling in sub-coulomb deuteron scattering .... See Entry 70556

Coulomb nuclear interference effects in the elastic and inelastic scattering of ^{16}O and ^{18}O ions on ^{70}Ge .... See Entry 70577

Neutron-excess dependence of fusion—Ni+Sn .... See Entry 70638

24.30 RESONANCE REACTIONS AND SCATTERING

70525 Spins and parities of the resonance states of ^{24}Mg which are excited in the ^{23}Na(p,α)^{20}Ne and ^{23}Na(p,p$_h$)^{23}Na* reactions for E_p=6.27, 6.37 and 6.52 MeV. S.S.Vasil'ev, M.S.Golovkov, T.N.Mikhaleva, D.L.Chuprunov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.104-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.940-3 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The angular distributions of the particles of the ^{23}Na(p,α)^{20}Ne and ^{23}Na(p,p$_h$)^{23}Na reactions are investigated for the resonance states which arise in ^{24}Mg for E_p=6.27, 6.37 and 6.52 MeV. (6 refs.)

70526 Spreading width of Gamow-Teller resonances in ^{208}Bi. S.Adachi (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.5-8 (19 May 1983).
The spreading width of the Gamow-Teller resonance in ^{208}Bi is studied in the self-consistent TDA with the Skyrme interaction. Coupling between 1p1h states and 2p2h states are included in the TDA linear response function. (10 refs.)

70527 Collisional spreading of small amplitude nuclear vibrations. M.C.Nemes (Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany), A.F.R.de Toledo Piza.
Z. Phys. A (Germany), vol.310, no.4, p.399-44 (1983).
The authors present a microscopic treatment of the spreading widths of giant resonances—a collisional RPA (with complex frequencies, $z=i\omega+\gamma$) which turns out to have a very simple analytical form. It includes the usual mean field contribution, which reproduces the frequencies of the collisionless RPA, and also non-unitary (collision) contributions which arise from the inclusion of quantum correlation effects in the weak coupling approximation. This collisional RPA equation can be easily put to quantitative use in realistic nuclear structure problems. (7 refs.)

70528 Statistical properties of 3/2$^+$ resonances in ^{49}V. P.Ramakrishnan, B.H.Chou, G.E.Mitchell (North Carolina State Univ., Raleigh, NC, USA), E.G.Bilpuch, R.O.Nelson, J.F.Shriner,Jr., C.R.Westerfeldt.
Z. Phys. A (Germany), vol.311, no.3, p.157-62 (1983).
Amplitude and width correlations were determined for three decay channels for 30 3/2$^+$ resonances in ^{49}V. Singles and coincidence measurements were employed in this first determination of relative signs of decay amplitudes for 3/2$^+$ resonances. Very large amplitude and width correlations are observed. (16 refs.)

70529 Microscopic study of ^{16}O+^{15}N. S.Okabe (Dept. of Phys., Hokkaido Univ., Sapporo, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.72
In systems composed of two nearly identical nuclei scattering and reaction phenomena have been analysed by some models of nucleus-nucleus interactions with parity dependence. In order to study the parity dependence which originates in the total anti-symmetrization the author treats an ^{16}O+^{15}N system as a typical example in a framework of the RGM-GCM equation with the M3Y effective nucleon-nucleon potential (Reid even and Eliott odd central, Reid spin-orbit). (2 refs.)

A compilation of resonance integrals from hydrogen to fermium .... See Entry 69798

Microscopic study of molecular bands and their crossing .... See Entry 70444

About the unified description of elastic and inelastic cross sections in heavy-ion collisions .... See Entry 70521

The theory of electron-scattering coincidence experiments .... See Entry 70544

Molecular resonances and spin alignment in ^{12}C+^{16}O inelastic scattering .... See Entry 70574

Excitation of giant resonances by inelastic scattering of 400 MeV ^{16}O .... See Entry 70617

Study of the gamma decay of states excited via inelastic scattering of alpha and ^{16}O beams .... See Entry 70618

Mutual inelastic excitations .... See Entry 70620

High resolution excitation function measurements and resonant structures in the ^{16}O-^{16}O-system at the Coulomb barrier .... See Entry 70621

The role of the Y_1* resonances in the $\bar{K}$-nucleus reactions at medium energies .... See Entry 70626

24.50 DIRECT REACTIONS

70530 Investigation of the mechanism of the (^{3}He,α) reaction of the ^{13}C nucleus. G.S.Gurevich, V.M.Lebedev, N.V.Orlova, A.V.Spasskii, I.B.Teplov, L.N.Fateeva, L.Mestre (Sci. Res. Inst. of Nuclear Phys., M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.59-63 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.897-902 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
Investigates the mechanism of the ^{13}C(^{3}He,α)^{12}C reaction with the production of a final nucleus in the first excited state. ^{3}He particles of energies 18 and 23 MeV were used. Based on the results of comparing the shape of the experimental angular distributions with the theoretical distributions, the authors concluded that the principal reaction mechanism is the nucleon-pickup mechanism. (14 refs.)

70531 On the polarisation and interference phenomena in the process of electrospallation of a deuteron. D.Ishankuliev, B.K.Kerimov, A.A.Sokolov (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.97-103 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.934-9 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
The spallation of a deuteron by longitudinally polarised electrons $e^-_{L,R}+d\rightarrow n+p+e^-$ is considered in the momentum approximation with allowance for the polarisation of the produced proton. The differential cross section of the process is calculated with simultaneous allowance of the electromagnetic interaction and the WNC interaction. Calculations of the P-odd effects are carried out within the framework of four gauge models which are based on the groups SU(2)$\otimes$U(1) and SU(3)$\otimes$U(1). (10 refs.)

The ^{3}He(γ,2*p*)*n* reaction for E_γ=80-170 MeV .... See Entry 70543

***D*-state and multistep effects in (α,*d*) reactions** .... See Entry 70558

Pre-equilibrium and knock-out processes in (α,2α) reactions ... See Entry 70562

Single nucleon transfer reactions in a core excitation model for ^{48}Ti incident on ^{42}Ca at 8 MeV/amu .... See Entry 70572

Energy dependence of heavy target fragmentation in nucleus-nucleus collisions .... See Entry 70624

24.60 STATISTICAL THEORY AND FLUCTUATIONS

70532 Density of bound and unbound exciton states in the microscopic model of preequilibrium nuclear reactions. F.A.Zhivopistsev, E.I.Kebin, V.G.Sukharevskii, V.A.Khaimin (Sci. Res. Inst. of Nuclear Phys., M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.48-53 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.885-91 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981). (11 refs.)

70533 Two-component exciton model. J.Dobes (Inst. of Nuclear Phys., Czechoslovak Acad. of Sci., Rez, Czechoslovakia), E.Betak.
Z. Phys. A (Germany), vol.310, no.4, p.329-38 (1983).
The exciton model of nuclear reactions with the distinguishabilty of protons and neutrons explicitly included is discussed. The Pauli master equation and transition rates in this two-component formulation are given. Both the simple considerations and actual calculations show that the two-component model exhibits new features and modifies conclusions of the one-component formulation. The ratio of the proton to neutron preequilibrium emissions in proton induced reactions decreases twice to three times when compared with the usual one-component model. (25 refs.)

70534 The nuclear response time in precompound reactions. M.Kawai, H.A.Weidenmuller (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Z. Phys. A (Germany), vol.311, no.1-2, p.117-18 (1983).
Using an improved estimate based on a quantal expression for the nuclear response time the authors show that in the phenomenological models for precompound reactions, the condition for the validity of the Markov approximation is nearly satisfied. (8 refs.)

70535 Statistical approach to composite particle emission. W.A.Friedman, W.G.Lynch (Michigan State Univ., East Lansing, MI, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.22
Considerable attention has recently been directed to the relative multiplicities of various fragments produced in energetic nuclear reactions in the belief that these will provide evidence regarding the underlying thermodynamics of the reactions. Indeed, it has been suggested that the apparent power-law behavior observed in the dependence of multiplicity on fragment mass, A_F, is a signature for a liquid-gas nuclear phase transition. The authors have calculated the time evolution of an ensemble-averaged excited system which undergoes statistical emission. They easily include nucleon fragments with A_F up to 20 by using the phase space considerations of the Hauser-Feshbach theory. The calculations, which include isospin effects, Coulomb barriers and emitter recoil, follow these and other related quantities as the excited system cools. They obtain the time integrated multiplicities and spectra for each of the emitted fragments. (3 refs.)

70536 On the description of multiplicity distributions in multiple production processes in terms of combinants. J.Bartke (Lab. of High Energies, JINR, Dubna, USSR).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.28
Multiplicity distributions of secondary particles produced in high energy reactions are usually described in terms of their statistical moments or other parameters closely related to the moments (average multiplicity, dispersion,

skewness, etc.). It has been proposed to analyze multiplicity distributions in terms of another set of probability coefficients related to probability ratios P(m)/P(n). These coefficients are denoted C(k), and called 'combinants'. The author applies the combinants for the description of the experimental multiplicity distributions of negative secondaries produced in interactions of high energy hadrons and nuclei. (7 refs.)

70537 On some characteristics of the multiplicity distributions of shower particles originating from proton-emulsion interactions below 20 GeV. M.Sumbera, S.Vokal (Lab. of High Energies, JINR, Dubna, USSR).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.29
The authors report on the properties of n_s-distributions obtained from p+Em interactions at $E_0 \leq 20$ GeV. They show that for this region of primary energies approximate KNO-scaling holds. The best fit is obtained with the Buras parametrization. (2 refs.)

70538 The effects of composite particle formation in the (A,B) and (A,Bγ) pre-equilibrium reactions. V.G.Sukharevsky, F.A.Zivopistsev (Inst. of Nuclear Phys., Moscow Univ., Moscow, USSR).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.36
The mechanisms of emission of composite particles ($A \leq 4$) have been analysed in the framework of the quantum-field model of pre-equilibrium reactions. The intermediate states (IS) are classified by the number of quasiparticles, the effective interactions between them being different from the interaction of free particles. The reaction results in free composite particles B. The factors of transition of quasi-particles $\langle \gamma_B \uparrow \rangle$ to a free composite particle in the outlet channel are determined. All possible emission mechanisms (direct knock-out, stripping or pick-up, coalescence) are taken into account in $\langle \gamma_B \uparrow \rangle$. The determination of $\langle \gamma_B \uparrow \rangle$ permits one to obtain the absolute cross-section value without employing the fitting parameters. The model analysis of the γ-quantum emission spectrum for the (A,Bγ) reactions have been made. The analysis shows that the smooth γ-quantum energy spectrum is determined by annihilation of the quasi-particle−quasi-hole pair and by the quasi-particle or quasi-hole γ-emission. The radiation transitions accompanying the formation of a composite particle determine the characteristic γ-quantum spectrum depending on the type of many-stage formation mechanism of a composite particle. This is, mainly, due to relaxation through the IS of the continuum. In this process the formation probability of a group of nucleons with parallel momenta is high, which determines a large yield of composite particles. (2 refs.)

Evidence for 3p-2h rotational bands in ^{17}O ......See Entry 70436

The mean free path of protons in nuclei and the nuclear radius ......See Entry 70448

γ-decay of the states of ^{55,56}Fe excited in the (n,xnγ) reaction on ^{56}Fe at E_n=14.6 MeV ......See Entry 70482

Solution of the reduced occupation-number equation for a fermion system ......See Entry 70512

Equilibrium and nonequilibrium sequential emission of light particles in deeply inelastic collision (DIC) ......See Entry 70515

Statistical properties of $3/2^+$ resonances in ^{49}V ......See Entry 70528

Interaction of relativistic alpha particles in emulsion at 2.1 GeV/c/nucleon ......See Entry 70560

Noncompound light particle emission in nucleus-nucleus collisions ......See Entry 70566

Thermodynamics of phase transition expected in HI collision at high energy ......See Entry 70567

Mass spectrum of dilepton produced in relativistic heavy ion collision ......See Entry 70568

Light fragment emission in the model of transport theory for high-energy nucleus-nucleus collisions ......See Entry 70569

The coalescence phenomenon and the Pauli quenching in high-energy heavy ion collisions ......See Entry 70570

Maximum-entropy analysis of heavy-ion transfer reactions and the exciton model ......See Entry 70571

Statistical analysis of the elastic and inelastic scattering of ^{12}C+^{28}Si and ^{16}O+^{28}Si ......See Entry 70579

Mass distributions of fission fragments emitted by highly excited nuclei ......See Entry 70633

Multistep nature of heavy-ion fusion reactions ......See Entry 70640

24.70 POLARIZATION IN REACTIONS AND SCATTERING

70539 Spin-spin correlations and spin-asymmetries for the reaction $\vec{p}\vec{p} \to pn\pi^+$ at 510 MeV. R.Shypit, C.E.Waltham, D.A.Axen, F.Entezami (Phys. Dept., Univ. of British Columbia, Vancouver, BC, Canada), M.Comyn, D.Healey, G.A.Ludgate, G.D.Wait, D.V.Bugg, J.A.Edgington, N.R.Stevenson.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.314-16 (5 May 1983).
Spin-spin correlation parameters A_{LL}, A_{NN}, A_{SS} and spin-asymmetries A_B and A_T have been measured for the reaction $\vec{p}\vec{p} \to pn\pi^+$ with an incident beam energy of 510 MeV. Clean separation of free-proton events from the carbon background has been achieved. Results agree well with the predictions of Dubach, Kloet and Silbar (1982). (12 refs.)

70540 Structure of the mass operator in finite Fermi systems. V.I.Belyak, G.M.Vagradov (Inst. of Nuclear Res., Acad. of Sci., USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.899-906 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.431-42 (Sept. 1982). [received: May 1983]
The field methods of many-body theory are used to consider the structure of the mass operator in finite Fermi systems. It is shown to have a pole dependence on the energy. Various approximate methods of determining it are discussed. The general properties of the quasiparticle spectrum are investigated on the basis of the obtained form of the mass operator. (6 refs.)

70541 Gamma-ray polarization and nuclear orientation measurements on ^{182}TaFe. J.Rikovska, D.Novakova (Dept. of Phys., Czechoslovak Tech. Univ., Prague, Czechoslovakia), J.Ferencei, M.Finger.
Z. Phys. A (Germany), vol.311, no.3, p.185-93 (1983).
The results of combined measurements of the directional distribution and the linear polarization of gamma-rays from oriented ^{182}TaFe are reported. Construction and calibration of a Compton polarimeter based on a single planar Ge(Li) detector are described. The degree of the linear polarization and multipole mixing ratios for many gamma-transitions in ^{182}W have been deduced. A triple multipole mixing $E1+M2+E3$ of the 1274 keV transition has been obtained with $_1(M2/E1)=+0.36(10)$ and $\delta_2(E3/E1)=-0.28(12)$. Results are discussed in the framework of the rotational model. Strong evidence of the octupole vibrational nature of the 1289 keV level in ^{182}W has been found. (30 refs.)

70542 Measurement of the polarization parameter P in π^+p elastic scattering in the region of low-lying pion-nucleon resonances. V.V.Abaev, V.S.Bekrenev, Yu.A.Beloglazov, V.G.Gaditsky, A.I.Kovalev, S.P.Kruglov, A.A.Kulbardis, I.V.Lopatin, A.N.Prokofiev, V.V.Sumachev, V.Yu.Trautman, E.P.Fedorova-Koval, E.A.Filimonov, A.V.Shvedchikov (Leningrad Nuclear Phys. Inst., Acad. of Sci., Leningrad, USSR).
Z. Phys. A (Germany), vol.311, no.3, p.217-23 (1983).
Presents the results of an experiment in which the polarization parameter P in π^+p elastic scattering has been measured in the energy range from 335 to 580 MeV. The experiment was performed on a pion channel of the LNPI synchrocyclotron using a polarized proton target and wire spark chambers with magnetostrictive read-out. The results have substantially higher precision in comparison with most of the other experiments in this energy range and allow to determine unambiguously the shape of angular dependence $P(\theta^*)$ in the whole investigated region. New phase-shift analysis of π^+p scattering data has been performed. The results of this experiment were used also to check isospin invariance. (23 refs.)

P-odd effects in the deuteron electrodisintegration $e+d \to e^- + n + p$ ......See Entry 70395

Study of spin-orbit interaction of ^{13}C and ^{15}N nuclei in ^{14}C induced transfer reactions on ^{138}Ba ......See Entry 70438

The parity violating rotation of the neutron spin in helium ......See Entry 70450

Polarization effects of currents of the second kind during β^--decay ......See Entry 70501

The 1^-(1.9 MeV β^-)2^+ transition in the decay of ^{148}Pm ......See Entry 70505

On the polarisation and interference phenomena in the process of electrospallation of a deuteron ......See Entry 70531

Relativistic impulse approximation for *p*-nucleus elastic scattering ......See Entry 70550

Polarization in inclusive scattering of protons from nuclei at 1 GeV ......See Entry 70552

On the spin-dependence of transfer channel coupling in sub-coulomb deuteron scattering ......See Entry 70556

Measurement of cross-sections and analysing powers for the break-up of polarised ^{3}He ......See Entry 70563

24.75 GENERAL PROPERTIES OF FISSION

A compilation of resonance integrals from hydrogen to fermium ......See Entry 69798

Role of the deformation of multipolarity six in the dynamic description of spontaneous fission ......See Entry 70628

Mass distributions of fission fragments emitted by highly excited nuclei ......See Entry 70633

25.00 NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS

25.10 NUCLEAR REACTIONS AND SCATTERING INVOLVING FEW-NUCLEON SYSTEMS

Mass number dependence of large transverse momentum production and massive lepton pair production: effects of multi-quark clusters on high energy reactions off nuclear targets ......See Entry 70343

Spin-spin correlations and spin-asymmetries for the reaction $\vec{p}\vec{p} \to pn\pi^+$ at 510 MeV ......See Entry 70539

Estimate of the error of solving the integral equation with the local potential for scattering of a nucleon by a deuteron ......See Entry 70547

The proton-deuteron scattering lengths ......See Entry 70551

Some problems in the microscopic theory for the interaction of complex nuclei ......See Entry 70559

25.20 PHOTONUCLEAR REACTIONS AND PHOTON SCATTERING

70543 The ^{3}He(γ,2*p*)*n* reaction for E_γ=80-170 MeV. C.A.Peridier, J.L.Matthews, M.J.Leitch (Dept. of Phys., MIT, Cambridge, MA, USA), H.Jeremie, M.Irshad, B.L.Roberts.
Z. Phys. A (Germany), vol.310, no.4, p.317-28 (1983).
The cross section for the ^{3}He(γ,2*p*) reaction has been measured in a complete kinematics experiment in the energy range E_γ=80-170 MeV, for $\theta_{p1}=\theta_{p2}=90°$. This configuration was selected in order to investigate the role of proton-proton final state interactions in the three-body breakup process. The measured proton spectra are seen to be consistent with a prediction using the Watson-Migdal formalism. The magnitude of the observed cross section clearly indicates an enhancement over phase space, presumably due to the strong proton-proton interaction in the final state. The experimental results agree, within their limited statistical accuracy, with a theoretical calculation which includes this effect. (35 refs.)

25.30 LEPTON-INDUCED REACTIONS AND SCATTERING

70544 The theory of electron-scattering coincidence experiments. W.E.Kleppinger, J.D.Walecka (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
Ann. Phys. (USA), vol.146, no.2, p.349-94 (1 April 1983).
A general expression for the electron-scattering coincidence cross section for the reaction $A_1(e,e'X)A_2$ with a nuclear target is derived in the one-photon exchange approximation. Tables of angular correlation coefficients are given for the case where the initial nucleus A_1 has $J_1^\pi=0^+$. Connection is made in the 'static limit', and with the assumption that the reaction proceeds through

a finite number of Breit-Wigner resonances with a corresponding factorisation of the electroproduction transition matrix elements, to the familiar electromagnetic transition multipole moments involving excitation of a nuclear state J^π. Analytic expressions for the coincidence cross sections are given for spin-zero systems and some very simple, basic models of nuclear 'giant resonance' excitations. Finally, a reanalysis of the recent Stanford data of Calarco et al. (1980) on $^{12}C(e,e'p_0)\ ^{11}B(3/2^-)$ in the vicinity of the giant dipole resonance in ^{12}C is carried out using a very simple nuclear model but retaining all the terms in the coincidence cross section, some of which were previously neglected. (26 refs.)

70545 Electron scattering from ^{13}C. Il.Tong Cheon (Internat. Centre for Theoretical Phys., Trieste, Italy).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.451-7 (12 May 1983).
Transverse form factors for elastic and inelastic electron scattering from ^{13}C have been calculated with the Cohen-Kurath wave functions, by introducing an alteration into the nucleon form factor in nuclei. The results show good agreement with the data. The author has concluded that the Cohen-Kurath wave function can reproduce the experimental results of photopion production and electron scattering from ^{13}C in the momentum transfer, $q \lesssim 2\ \mathrm{fm}^{-1}$. (16 refs.)

Electron scattering from nuclear targets and quark distributions in nuclei .... See Entry 70394

P-odd effects in the deuteron electrodisintegration $e+d \to e^- + n + p$ .... See Entry 70395

Electroexcitation of 2^+ and 4^+ states in ^{28}Si: a test of the renormalized shell model .... See Entry 70449

Axial meson exchange current effects in deuterium in the current algebra approximation .... See Entry 70458

Combined analysis of inelastic electron-scattering and muonic-atom hyperfine-splitting data: an application to ^{152}Sm .... See Entry 70489

On the polarisation and interference phenomena in the process of electrospallation of a deuteron .... See Entry 70531

Total kinetic energy release and mass distributions in prompt and delayed muon induced fission of ^{238}U .... See Entry 70631

25.40 NUCLEON-INDUCED REACTIONS AND SCATTERING

(see also 28.20 Neutron physics)

70546 Calculation of the cross section of the $^6Li(n,nd)^4He$ reaction with the cluster wave functions of the ^6Li nucleus. L.M.Lazarev.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.76-82 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.914-20 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
A brief exposition is given of the formalism of a semi-microscopic method, and then this method is demonstrated using the example of the problem of the scattering of three bosons, the interaction between which, is described by point pair potentials. The result of calculating the cross section of the (n,nd) reaction on the ^6Li nucleus using the cluster wave functions of the target nucleus as the basis functions, is also presented. (12 refs.)

70547 Estimate of the error of solving the integral equation with the local potential for scattering of a nucleon by a deuteron. E.I.Dubovoi, Z.F.Kertkoev, V.P.Yakovlev (Radioengng. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.94-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.931-3 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
In a previous work (Dubovoi et al., 1982) it was demonstrated that a fundamental constraint exists on the accuracy of solving the system of integral equations of the three-nucleon scattering problem. It is due on the one hand to errors in determining the phase shifts of nucleon-nucleon scattering—to the necessity of discarding the high phases, and on the other hand to the necessity of increasing the dimensionality of the numerical matrix of the system of algebraic equations corresponding to the integral equations. In using a nonlocal separable potential one can describe the data on the cross section and polarisation with an error of not less than 10 to 30% when the s-, p- and d-waves are taken into account. The authors consider the solution of this same problem with a local potential. (14 refs.)

70548 Optimization of irradiation parameters for ^{67}Ga production from $^{nat}Zn(p,xn)$ nuclear reactions. M.Bonardi, C.Birattari (Istituto Sci. Fisiche, Univ. of Milan, Milano, Italy).
J. Radioanal. Chem. (Switzerland), vol.76, no.2, p.311-18 (1983).
Excitation functions for $^{nat}Zn(p,xn)$ and (p,pxn) nuclear reactions in the 5-45 MeV proton energy range were measured. Evaluations were made both of target thickness and proton energy in order to optimize the ^{67}Ga production rate, at the same time minimizing contamination by ^{66}Ga. Optimal irradiation conditions, depending both on the beam current available and on the power dissipated into the target were determined. (16 refs.)

70549 Impulse-approximation Dirac optical potential. J.A.McNeil (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA), J.R.Shepard, S.J.Wallace.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1439-42 (9 May 1983).
The impulse approximation to the Dirac optical potential for proton-nucleus elastic scattering is deduced from elementary considerations and found to be in remarkably good agreement with phenomenological parameters. The large difference between the real parts of scalar and vector optical potentials is explained by the impulse approximation. (14 refs.)

70550 Relativistic impulse approximation for *p*-nucleus elastic scattering. J.R.Shepard (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA), J.A.McNeil, S.J.Wallace.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1443-6 (9 May 1983).
First calculations based on an impulse-approximation Dirac optical potential are presented. All input parameters are constrained by other experimentally determined quantities. Excellent agreement with $T_p = 500$ MeV $p_{pol} + {}^{16}O$ and ^{40}Ca elastic scattering data is demonstrated. The differences between the relativistic and nonrelativistic results are explored in detail. (21 refs.)

70551 The proton-deuteron scattering lengths. J.L.Friar, B.F.Gibson (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), G.L.Payne.
Phys. Lett. B (Netherlands), vol.124B, no.5, p.287-92 (5 May 1983).
Proton-deuteron quartet and doublet scattering lengths resulting from configuration-space Faddeev calculations are reported. The values of $^4a_{pd} \approx 14$ fm and $^2a_{pd} \approx 0.1$ fm differ substantially from the accepted experimental values and from theoretical estimates using approximate methods to include Coulomb effects. An explanation of the results in terms of the two-body strong-plus-Coulomb potential is provided. (17 refs.)

70552 Polarization in inclusive scattering of protons from nuclei at 1 GeV. S.L.Belostotsky, Yu.V.Dotsenko, J.Ero, Z.Fodor, L.G.Kudin, N.P.Kuropatkin, A.A.Lobodenko, O.V.Mikluho, V.N.Nikulin, O.E.Prokof'ev, Z.Seres, E.N.Volnin, A.A.Vorobyov (Leningrad Nuclear Phys. Inst., Gatchina, USSR).
Phys. Lett. B (Netherlands), vol.124B, no.6, p.469-70 (12 May 1983).
The authors have measured the polarization of protons produced in inclusive proton-nucleus reaction $p+A \to p+X$ at 1 GeV. Measurements have been done using a double scattering technique with a magnetic quadrupole spectrometer and a proportional chamber polarimeter. The polarization of backward protons is found to be close to zero. (9 refs.)

70553 Carbon and deuterium nuclear scattering of 48.5 MeV protons. V.I.Grantsev, V.I.Konfederatenko, V.A.Kornilov, O.F.Nemets, R.G.Ofengenden, B.A.Rudenko, M.V.Sokolov, B.G.Struzhko.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.506-11 (April 1983). In Russian.
Differential cross-sections of elastic 48.5 MeV proton scattering by ^{12}C, hydrogen and deuterium nuclei were measured. The experimental results are compared with values obtained from a numerical solution of Faddeev integral equations with *S*-wave separable Yamaguchi potentials and charge-dependent forces. (22 refs.)

70554 Catastrophic destruction of heavy emulsion nuclei induced by fast hadrons. M.El-Nadi, A.T.Baranik, A.El-Naghy, N.Mettwalli, O.E.Badawy, S.Akbd El-Halim (Phys. Dept., Faculty of Sci., Cairo Univ., Cairo, Egypt).
Z. Phys. A (Germany), vol.310, no.4, p.301-6 (1983).
Photoemulsions were irradiated to 8.4, 9.6, (69 GeV/c) protons and 4.2 GeV/c/nucleon ^{12}C ions. Large stars, having a number of heavily ionizing particles $n_h \geq 28$, were selected for this study. These events represent the catastrophic destruction of AgBr emulsion nuclei. Multiplicity, angular and energy distributions of particles, produced in this case, were studied at different momenta and for different incident particles. It was shown that the products of complete destruction of heavy nuclei are nearly individual nucleons. The probability of this phenomenon increases with the projectile mass number. About half of nuclear matter is knocked out of the target nucleus with energy higher than 30 MeV/nucleon. The average multiplicity of *s*-particles $\bar{n}_s$ is weakly dependent on the target nucleus mass number whereas the average multiplicity of *g*-particles $\bar{n}_g$ is strongly dependent on it. The modified pre-equilibrium model gives a satisfactory description for the energy spectrum of the emitted slow protons. (26 refs.)

70555 Elastic backscattering cross sections of protons on oxygen. M.Braun, T.Fried (Res. Inst. of Phys., Stockholm, Sweden).
Z. Phys. A (Germany), vol.311, no.3, p.173-5 (1983).
Absolute values of elastic scattering cross sections of protons in the energy region 600-2000 keV have been measured on oxygen for scattering angles between 110 and 160°. The method applied in the present work is advantageous in regard to determine absolute cross sections, since quantities such as proton particle fluence and detection geometry can be neglected. The results show that the measured cross sections are considerably higher than Rutherford cross sections for proton energies close to 2000 keV. No resonances are observed in the energy region studied. (5 refs.)

A compilation of resonance integrals from hydrogen to fermium .... See Entry 69798

Bound coherent and incoherent thermal neutron scattering cross sections of the elements .... See Entry 69799

Excitation of the collective states of nuclei of the transitional region having $A \approx 190$ to 200 for inelastic scattering of low-energy neutrons .... See Entry 70429

Deformation correlation effects in the ^{154}Sm-^{144}Sm neutron density difference .... See Entry 70447

The parity violating rotation of the neutron spin in helium .... See Entry 70450

γ-decay of the states of $^{55,56}Fe$ excited in the $(n,xn\gamma)$ reaction on ^{56}Fe at $E_n = 14.6$ MeV .... See Entry 70482

Angular distributions of γ-quanta from the $^{93}Nb(n,n'\gamma)$ reaction .... See Entry 70483

γ-radiation in the reaction $^{143}Nd\ (n,n'\gamma)$ using fast neutrons from a reactor .... See Entry 70486

The γ-spectrum of ^{156}Gd from the inelastic scattering of fast neutrons .... See Entry 70487

Decay properties of low-lying levels in ^{100}Rh .... See Entry 70490

A probabilistic model for spectral assignment in the (n,γ) reaction .... See Entry 70491

A coupled channel computing code for neutron-nucleus reactions .... See Entry 70510

Multiparticle production in hardon-nucleus and nucleus-nucleus collision .... See Entry 70513

The breakup of spectator residues in relativistic nuclear collisions .... See Entry 70517

On the nucleon optical potential in the one-boson exchange model .... See Entry 70523

Spins and parities of the resonance states of ^{24}Mg which are excited in the $^{23}Na(p,\alpha)^{20}Ne$ and $^{23}Na(p,p_h)^{23}Na^*$ reactions for $E_p = 6.27$, 6.37 and 6.52 MeV .... See Entry 70525

Statistical properties of $3/2^+$ resonances in ^{49}V .... See Entry 70528

On some characteristics of the multiplicity distributions of shower particles originating from proton-emulsion interactions below 20 GeV .. See Entry 70537

Spin-spin correlations and spin-asymmetries for the reaction $\vec{p}\vec{p} \to pn\pi^+$ at 510 MeV .... See Entry 70539

Backward particle production by protons and ^{12}C nuclei in emulsion at momenta 4.5 GeV/c/A .... See Entry 70588

Fission yields of In isotopes in the thermal neutron fission of ^{235}U .... See Entry 70634

Heavy nuclei disintegration mechanisms by 1 GeV protons .... See Entry 70636

In situ neutron activation analysis of and the neutron capture cross-section for $^{90}Sr^+$ .... See Entry 73385

25.50 ^{2}H- AND ^{3}H-INDUCED REACTIONS AND SCATTERING

70556 **On the spin-dependence of transfer channel coupling in sub-coulomb deuteron scattering.** J.A.Tostevin, R.C.Johnson (Dept. of Phys., Univ. of Surrey, Guildford, England).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.135-8 (28 April 1983).
It is shown that, for sub-Coulomb incident deuteron energies, coupling to weakly bound neutron transfer channels produces large changes in the calculated elastic channel vector analysing powers, iT_{11} as compared with those obtained using a folding model spin-orbit interaction. Coupled channels calculations for deuteron scattering from ^{208}Pb at 8 MeV and 9 MeV are in quantitative agreement with the experimental iT_{11} data. (15 refs.)

Neutral strange particles and π^0 production in the collisions of d and ^{12}C with Ta at 4.2 GeV/c/N momentum ....See Entry 70583

25.60 ^{3}HE- AND ^{4}HE-INDUCED REACTIONS AND SCATTERING

70557 **Elastic scattering of high energy alpha-particles on nuclei.** A.N.Antonov, V.A.Nikolaev, I.Zh.Petkov (Inst. for Nuclear Res. & Nuclear Energy, Acad. of Sci., Sofia, Bulgaria).
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.42-9 (1983).
The experimental data of elastic alpha-particle (1.37 GeV) scattering on ^{12}C and ^{40,42,44,48}Ca are successfully analysed in the framework of the model of coherent fluctuations of nuclear density. The values of the parameters (effective radius and surface thickness of the target nucleus) which appear in this approach are discussed. (18 refs.)

70558 ***D*-state and multistep effects in (α,*d*) reactions.** J.R.Comfort (Phys. Dept., Arizona State Univ., Tempe, AZ, USA), W.W.Daehnick.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1627 (16 May 1983).
Nagarajan and Satchler (1982) have attributed an observed sawtooth pattern in the integrated cross sections of the reaction ^{208}Pb(α,*d*) to states of the $h_{9/2}g_{9/2}$ multiplet in ^{210}Bi as arising from the relative *D*-state motion of two deuterons in the α particle. They predict that natural-parity transitions will be suppressed and unnatural-parity transitions enhanced with respect to one-step distorted-wave Born-approximation (DWBA) cross sections. The authors argue that the *D*-state modifications of one-step cross sections are contrary to the experimental patterns for multiplets whose J_{max} states have unnatural parity. (5 refs.)

70559 **Some problems in the microscopic theory for the interaction of complex nuclei.** Wu Guanghan, Yang Dailun (Inst. of Nuclear Sci. & Tech., Sichuan Univ., Chengdu, China).
Sci. Sin. (China), vol.26, no.4, p.390-401 (April 1983).
A new generating function is presented to solve the problem of the CM spurious state in unequal clusters. The Canto-Brink (1977) and Mito-Kamimura (1976) variational methods are derived from the stability principle and the results of the double Fourier transformation are deduced in a simple way. A general program is set up to derive analytically the GCM and RGM kernels, and the *a-a*, *a-He*^{3} and *a-t* elastic scattering phase shift is calculated. (19 refs.)

70560 **Interaction of relativistic alpha particles in emulsion at 2.1 GeV/c/nucleon.** O.E.Badawy, M.El-Nadi, S.A.El-Sharkawy, M.K.Hegab, M.M.Sherif (Phys. Dept., Cairo Univ., Giza, Egypt).
Z. Phys. A (Germany), vol.311, no.1-2, p.105-12 (1983).
An analysis for 2000 events produced by 2.1 GeV/c/N alpha particles in nuclear emulsion has been carried out. Multiplicity and angular distributions of charged secondaries have been measured and correlations among them are discussed. The presented data are compared with relevant values from proton and ^{14}N interactions with nuclei. The multiplicity distribution of showers has been tested by a modified independent nucleon-nucleus multiple scattering model (El-Sharkawy, 1980) and the model Gasparyan et al. (1979). (16 refs.)

70561 **Light ion induced Hanbury-Brown Twiss proton correlations near the Fermi energy.** R.A.Cecil, S.T.Thornton, R.L.Parks (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA), G.R.Young, T.C.Awes, T.N.Tad-deucci.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.14
The authors report initial results from a study of the Hanbury-Brown Twiss (HBT) small relative momentum proton-proton correlations from a 146 MeV alpha beam incident on a ^{60}Ni target. (3 refs.)

70562 **Pre-equilibrium and knock-out processes in (α,2α) reactions.** H.Machner (Univ. of Bremen, Bremen, Germany), U.Bechstedt, A.Budzanowski, P.Jahn, C.Mayer-Boricke.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.19
The authors study the ^{58}Ni(α,α'c) reactions at E_α=140 MeV. The charged particles c have been detected in the reaction plane given by the beam and inelastically scattered α'-particles by $\theta_{\alpha'}=-30°$. The coincident particles detected were mainly protons and a few α-particles. The cross sections have been transformed into the rest system of the recoiling nucleus. The integrated α'-yield shows a strong assymmetry while the integrated p-yield seems more or less isotropic. This may have its origin in relatively strong contributions from quasifree (α,2α) reactions. They assume that the incoming α-particle interacts quasifree with a target nucleon transferring energy and linear momentum. This nucleon induced reaction should represent the cross section except the knockout of an α-particle. They compare the α-particle spectrum under $\theta_c=30°$ with inclusive (p,α) data corrected for the recoil direction. (5 refs.)

70563 **Measurement of cross-sections and analysing powers for the break-up of polarised ^{3}He.** N.E.Sanderson, P.V.Drumm, J.B.A.England, J.M.Nelson, J.M.Barnwell, O.Karban (Phys. Dept., Univ. of Birmingham, Birmingham, England).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.40
The study of the break-up of composite particles has received increasing attention in recent years. For light ions (A≤4) microscopic calculations are now being undertaken with a good degree of success. A full understanding of the break-up reactions in these light systems is an important step towards unravelling the mechanisms which develop in heavy ion reactions at higher energies. In order to provide yet more stringent tests of these and other models measurements have been performed, for the first time, of break-up using polarised ^{3}He projectiles. As in the analysis of two-body reactions, study of polarisation effects are expected to be very sensitive to assumptions about the reaction mechanism. The experiments were carried out using the 33 MeV polarised ^{3}He beam at the University of Birmingham cyclotron. Four counter telescopes were used to record both the inclusive and coincidence spectra over a wide range of angle combinations. The d-p coincidence spectra show events mainly corresponding to the quasi-elastic break-up of ^{3}He. The angular correlations and the corresponding analysing power for the elastic break-up on a ^{12}C target are shown. The analysing power, which relates to the difference in the break-up yield for spin-up and spin-down projectiles, is large particularly for wider separation angles between the coincident particles. Measurements on other targets show a large analysing power also for ^{27}Al, but much smaller for ^{58}Ni. (2 refs.)

Mass number dependence of large transverse momentum production and massive lepton pair production: effects of multi-quark clusters on high energy reactions off nuclear targets ....See Entry 70343

The quadrupole moment of ^{176}Lu ....See Entry 70451

The 8$^+$ levels of ^{86}Zr revisited ....See Entry 70453

α+^{14}C dinuclear molecular band in ^{18}O: a new perspective into heavy ion scattering resonant phenomena ....See Entry 70457

The breakup of spectator residues in relativistic nuclear collisions ....See Entry 70517

Investigation of the mechanism of the (^{3}He,α) reaction of the ^{13}C nucleus ....See Entry 70530

Light particle emission in α and ^{12}C induced reactions between 25 and 84 MeV/u ....See Entry 70594

'Absolute' alpha transfer strength with ^{6}Li projectiles and alpha resonance width ....See Entry 70616

Study of the gamma decay of states excited via inelastic scattering of alpha and ^{16}O beams ....See Entry 70618

The cross-section for the binary and ternary fission of uranium and lead induced by 5.1, 8.8 and 12.7 GeV alpha-particles ....See Entry 70630

25.70 HEAVY ION INDUCED REACTIONS AND SCATTERING

70564 **Formation of the mass and angular distributions of the products of reactions with heavy ions.** P.A.Cherdantsev (Tomsk Polytech. Inst., Tomsk, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.67-70 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.906-9 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981). (5 refs.)

70565 **The influence of the zero-point oscillation on the charge transfer in the heavy-ion deep-inelastic collisions.** Ge Lin-xiao, Shen Wen-qing, Yu Chao-fan (Inst. of Modern Phys., Acad. Sinica, Lanzhou, China).
Chin. Phys. (USA), vol.3, no.1, p.101-6 (Jan.-March 1983). [received: May 1983]
The authors discuss the variance of the charge distribution in the heavy-ion deep-inelastic collision on the basis of the Langevin equation. In order to explain the difference of the initial slope (early stage) of the charge distribution for the different reaction systems and different bombarding energies, an initial condition of the charge drift in the early stage of DIC is introduced. It is given by the harmonic or inharmonic motion around the zero point and depends closely on the nuclear structure and incident energy. The difference of the inertial mass and stiffness parameter may be one of the reasons for the difference of charge transfer. In addition, they also analyze the characteristics of the inertial mass parameter. (9 refs.)

70566 **Noncompound light particle emission in nucleus-nucleus collisions.** C.K.Gelbke (Dept. of Phys., Michigan State Univ., East Lansing, MI, USA).
Comments Nucl. & Part. Phys. (GB), vol.11, no.6, p.259-76 (1983).
Present experimental results of noncompound light particle emission are consistent with the concept of statistical equilibrium for a subset of nucleons. By studying the energy dependence of composite light particle emission, one may eventually obtain information about the transition between the liquid and gas phases of nuclear matter. (20 refs.)

70567 **Thermodynamics of phase transition expected in HI collision at high energy.** A.Hasegawa (Dept. of Phys., Saga Univ., Saga, Japan), H.Tanaka.
Prog. Theor. Phys. (Japan), vol.69, no.2, p.685-8 (Feb. 1983).
The fireball model, which has a quark-gluon phase and a hadron phase, is proposed. Assuming a local thermal equilibrium for the fireball, the time and spatial behaviour of the two phases is investigated through a change in the local temperature $T(r,t)$ obtained by solving the relativistic non-linear diffusion equation. (9 refs.)

70568 **Mass spectrum of dilepton produced in relativistic heavy ion collision.** A.Hasegawa (Dept. of Phys., Saga Univ., Saga, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.689-92 (Feb. 1983).
The mass spectrum of dilepton emitted from the fireball born in HI central collisions is calculated. The fireball is assumed to consist of the quark-gluon phase and the pion phase. The mass spectrum at larger mass region is contributed mainly from the quark-gluon phase and the contribution from two phases can be distinguished experimentally. (4 refs.)

70569 **Light fragment emission in the model of transport theory for high-energy nucleus-nucleus collisions.** R.Malfliet (Kernfysisch Versneller Inst., Groningen, Netherlands), E.Martschew, B.Schurmann.
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.152-6 (28 April 1983).
The authors use the model of transport theory to calculate the nucleon distributions in the initial stage of the high-energy nucleus-nucleus collision. They assume composite particle formation to occur during the expansion phase of the initial hot zone, and they calculate the particle final inclusive spectra by using the concepts of equilibrium thermodynamics. The non-equilibrium features of the number and momentum distributions of the primordial nucleons are essential for the good agreement with the inclusive spectra measured in the reaction Ar on KCl at 800 MeV per nucleon. (16 refs.)

70570 **The coalescence phenomenon and the Pauli quenching in high-energy heavy ion collisions.** H.Schulz (Central Inst. for Nuclear Res., Rossendorf, Germany), G.Ropke, K.K.Gudima, V.D.Toneev.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.458-60 (12 May 1983).
Calculating the proton and deuteron spectra of high-energy heavy ion reactions by means of the cascade model it is argued that the effective account of the nuclear medium on the deuteron-like bound-state wave function requires a smaller coalescence radius of the respective momentum sphere compared with that obtained by using a deuteron wave function of two isolated nucleons. (12 refs.)

70571 Maximum-entropy analysis of heavy-ion transfer reactions and the exciton model. R.D.Levine (Fritz Haber Molecular Dynamics Res. Center, Hebrew Univ., Jerusalem, Israel).

Phys. Lett. B (Netherlands), vol.124B, no.6, p.461-4 (12 May 1983).

The author clarifies the concept of the prior distribution with special reference to the exciton model and apply it to energy disposal in heavy-ion transfer reactions. (14 refs.)

70572 Single nucleon transfer reactions in a core excitation model for ^{48}Ti incident on ^{42}Ca at 8 MeV/amu. C.Brendel, J.Carter, F.Beck, A.Richter, G.Schrieder (Inst. fur Kernphys., Tech. Hochschule, Darmstadt, Germany), D.Schull, G.Delic, R.H.Lemmer.

Phys. Lett. B (Netherlands), vol.124B, no.6, p.474-8 (12 May 1983).

Single neutron and proton quasi-elastic transfer in both directions have been studied in collisions of ^{48}Ti onto ^{42}Ca at $E_{\mathrm{Lab}}=385$ MeV. The main strength in the particle energy spectra lies below 12 MeV excitation energy and displays features specific to the reaction channel. A one-step direct transfer mechanisms which includes core excitation describes the main features of the spectra. (13 refs.)

70573 On the suppression of multiple rotational excitation in heavy ion inelastic scattering above the Coulomb barrier. A.J.Baltz, P.D.Bond (Brookhaven Nat. Lab., Upton, NY, USA).

Phys. Lett. B (Netherlands), vol.125B, no.1, p.25-9 (19 May 1983).

Quantum mechanical calculations of ^{134}Xe+^{152}Sm inelastic scattering indicate that heavy ion induced excitation of high spin rotational states should be strongly suppressed at bombarding energies above the Coulomb barrier. The several mechanisms contributing to this effect are discussed. (7 refs.)

70574 Molecular resonances and spin alignment in ^{12}C+^{16}O inelastic scattering. T.Tazawa (Tech. Coll., Yamaguchi Univ., Tokiwadai, Ube, Japan), J.Y.Park, Y.Abe.

Phys. Lett. B (Netherlands), vol.125B, no.1, p.30-4 (19 May 1983).

Recent data on spin alignment of the 3^- state (6.13 MeV) of ^{16}O are analysed from molecular viewpoints in the coupled channel approach. The dominance of the aligned configuration on resonances around 20 and 22 MeV is well explained in the framework of the band crossing model. (20 refs.)

70575 Shadowing of α-emitting fragments observed in 313 MeV ^{32}S+^{93}Nb collisions. G.-Y.Fan, H.Ho, P.L.Gonthier, W.Kuhn, A.Pfoh, L.Schad, R.Wolski, J.P.Wurm (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany), J.C.Adloff, D.Disdier, V.Rauch, F.Scheibling.

Z. Phys. A (Germany), vol.310, no.4, p.269-73 (1983).

Energy and angular correlations of α particles in coincidence with deeply inelastic fragments from ^{32}S+^{93}Nb reactions at 313 MeV were measured and the assumption of sequential α emission from the fragments tested. In the direction of the detected light fragment too few α particles from the heavy fragment are observed. This pronounced anomaly is ascribed to nuclear shadowing of the α particles by the proximate light fragment. (6 refs.)

70576 Moments of charge distributions in the reaction ^{92}Mo+^{92}Mo at 14.7 MeV/u. S.Gralla, Dai Guang-xi, A.Gobbi, K.D.Hildenbrand, W.F.J.Muller, A.Olmi, M.Petrovici, H.Stelzer, J.Toke, H.J.Wollersheim, R.Bock (Gesellschaft fur Schwerionenforschung, Darmstadt, Germany), U.Lynen.

Z. Phys. A (Germany), vol.310, no.4, p.345-6 (1983).

First and second moments of primary charge distributions were determined as a function of the total kinetic energy loss in the reaction ^{92}Mo+^{92}Mo at an incident energy of 14.7 MeV/u. Up to energy losses of 200 MeV no significant drift of the first moments is observed. The second moments are in agreement with predictions of a stochastic model derived at lower bombarding energies. (6 refs.)

70577 Coulomb nuclear interference effects in the elastic and inelastic scattering of ^{16}O and ^{18}O ions on ^{70}Ge. C.D.Uhlhorn, B.Gonsior (Inst. fur Experimentalphys., Ruhr-Univ. Bochum, Bochum, Germany), D.Wegner, K.P.Lieb, H.H.Wolter, A.M.Kleinfeld.

Z. Phys. A (Germany), vol.311, no.1-2, p.79-87 (1983).

Excitation functions of the elastic and inelastic scattering cross sections of ^{16}O and ^{18}O nuclei on ^{70}Ge have been measured at angles between 45° and 175° and at beam energies from 31.5 to 57 MeV. A DWBA analysis has been performed in which the composite structure of ^{18}O has been taken into account according to the approach developed by Landowne and Wolter (1979). Starting from an optical model potential determined from the elastic scattering data in the ^{16}O+^{70}Ge channel, a consistent description of the ^{16}O+^{70}Ge $(2^+, 3^-)$ target excitation, the ^{18}O+^{70}Ge elastic scattering and ^{18}O(2^+)+^{70}Ge projectile excitation cross sections near the Coulomb barrier has been obtained. (21 refs.)

70578 Products of $3\leq Z\leq 9$ from long-lived intermediates in the reactions 336 MeV ^{40}Ar+Ag, ^{154}Sm and Au. L.C.Vaz (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA), D.Logan, J.M.Alexander, E.Duek, D.Guerreau, L.Kowalski, M.F.Rivet, M.S.Zisman.

Z. Phys. A (Germany), vol.311, no.1-2, p.89-98 (1983).

Angular and energy distributions have been measured for products of $3\leq Z\leq 9$ from reactions of 336 MeV ^{40}Ar+$^{107.9}$Ag/^{154}Sm/^{197}Au. The c.m. differential cross sections and mean energies increase as one moves from ≈100 deg. to ≈170 deg. similar to those for fission or evaporation-like emission. Most characteristics mimic those observed for ^{4}He, but the cross-sections are smaller by a factor of ≈1/300 for each reaction studied. A semiclassical analysis has been used to estimate the effective barriers to emission and root-mean-square spins of the emitters. (33 refs.)

70579 Statistical analysis of the elastic and inelastic scattering of ^{12}C+^{28}Si and ^{16}O+^{28}Si. R.Singh (Dept. of Phys., North-Eastern Hill Univ., Shillong, India).

Z. Phys. A (Germany), vol.311, no.1-2, p.99-104 (1983).

A statistical model analysis has been performed on the $\theta_{\mathrm{c.m.}}=180°$ elastic and inelastic scattering excitation functions in the energy range $27.8\leq E_{\mathrm{c.m.}}\leq 31.5$ MeV for the ^{12}C+^{28}Si system and in the energy range $30.0\leq E_{\mathrm{c.m.}}\leq 32.7$ MeV for the ^{16}O+^{28}Si system. The exact calculation of the number of effective channels for inelastic excitation gives a value of ~1.5 corresponding to a change of 5° in the angle at which the cross sections are measured. The Hauser-Feshbach cross-sections, when compared to the experimental data, indicate very large (≥90%) direct reaction contributions to the observed cross sections. Good agreement between the theoretical and experimental distributions of the fluctuating cross sections together with the insignificant values of the cross correlation coefficient indicate that the fluctuating component of the experimental cross sections is consistent with the statistical model predictions. (19 refs.)

70580 Charge transfer prior to fusion. K.M.Hartmann (Sektion Phys., Univ. der Munchen, Munchen, Germany), D.H.E.Gross.

Z. Phys. A (Germany), vol.311, no.1-2, p.131-3 (1983).

In reactions between very asymmetric projectile-target systems charge is preferably transferred from the lighter to the heavier nucleus. This leads to a decrease of the potential barrier between the nuclei and increase of the fusion cross-section. The authors perform trajectory calculations with energy dissipation and proton transfer to estimate the magnitude of the effect. (10 refs.)

70581 Heavy-ion atomic physics. The decay of the vacuum and intermediate molecules. W.Greiner (Inst. fur Theoretische Phys., Johann Wolfgang Goethe Univ., Frankfurt am Main, Germany), W.Scheid.

In book: *Heavy ion collisions. Vol.3*, R.Bock [Ed.], p.299-482. Amsterdam, Netherlands: North-Holland (1982), x+666 pp. [0 444 85352 9]

Following a section on the autoionization of positrons, the authors cover the formal aspects of the change of a vacuum in overcritical fields. The authors discuss electron wave functions in overcritical electrostatic potentials, the effects of vacuum polarization and nonlinearities in the electromagnetic and spinor fields, and the two center Dirac problem. Other sections treat the decay of the neutral vacuum in overcritical fields during nucleus-nucleus collisions, background effects, overcritical phenomena for other fields and the case of broken symmetry, and dynamics of intermediate molecules, transitions in heavy ion collisions, selected effects in atomic heavy ion collisions, and finally the first QED experiments at GSI. (156 refs.)

70582 Hyperfine interactions in isolated ions. G.Goldring (Weizmann Inst. of Sci., Rehovot, Israel).

In book: *Heavy ion collisions. Vol.3*, R.Bock [Ed.], p.483-571. Amsterdam, Netherlands: North-Holland (1982), x+666 pp. [0 444 85352 9]

Having discussed the general concepts involved, the author goes on to treat the cases of cold and intermediate ionization of light nuclei. Hot ionization of heavy nuclei is also treated. (110 refs.)

70583 Neutral strange particles and π^0 production in the collisions of d and ^{12}C with Ta at 4.2 GeV/c/N momentum. G.Agakishiev.

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.1

γ-conversion pairs and Λ^0 decays from d and ^{12}C collisions with Ta target have been measured. After corrections, the average π^0 multiplicity for dTa collisions is 1.1±0.2 and for C-Ta is 3.6±0.3. The average π^0 multiplicity is proportional to the number of interacting projectile nucleons. The average Λ^0 multiplicity for C-Ta inelastic collisions is 0.04±0.01. About 40% of Λ^0s lie outside the kinematically allowed region for N-N collisions. The average transverse momentum of Λ^0 is 500±50 MeV/c. (no refs.)

70584 Pion production by 86 MeV/nucleon ^{12}C ions on nuclei. E.Aslanides (Centre de Recherches Nucleaires de Strasbourg, Strasbourg, France), T.Bressani, M.Caria, E.Chiavassa, S.Costa, G.Dellacasa, P.Fassnacht, M.Gallio, F.Hibou, B.Minetti, A.Musso.

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.2

The authors have measured the inclusive pion spectra produced at 0° by 86 MeV/nucleon ^{12}C ions on several nuclear targets (^{6}Li, ^{12}C, ^{27}Al, Cd and Pb). The experiment was performed by using the intense ($>10^{11}$ ions/second) beam from the CERN Synchro-cyclotron. The pion momenta were measured by means of a large solid angle magnetic spectrometer (Omicron). The momentum resolution was 2% fwhm. The measurements cover the range of pion momenta from 150 to 300 MeV/c and up to a sensitivity limit on the double differential cross sections of 10^{-36} cm^2/[sr. (MeV/c)]. The data are corrected for all the experimental uncertainties, including muon counting. (no refs.)

70585 A pion interferometry study of 1.5 GeV/A Ar-KCl collisions. D.Beavis, S.Y.Fung, W.Gorn, A.Huie, D.Keane, J.J.Lu, R.T.Poe, B.C.Shen, G.VanDalen (Dept. of Phys., Univ. of California, Riverside, CA, USA).

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.3

The authors report the preliminary results of a pion interferometry study of the negative pion source parameters for the reaction 1.5 GeV/A $\mathrm{Ar+KCl}\rightarrow 2\pi^- + X$. The triggered streamer chamber at Lawrence Berkeley Laboratory was used to acquire the data sample. The chamber was central-triggered on approximately 30% of the inelastic reaction cross-section giving an average negative pion multiplicity per event of 3.3. The sample includes 2700 events with $n_{\pi(\mathrm{sup.}\ -)}\geq 2$ which was used for this study. (3 refs.)

70586 Pion production below the free nucleon-nucleon threshold in heavy-ion reactions. J.P.Bondorf, C.Guet, B.Jakobsson, M.Prakash (State Univ. of New York, Stony Brook, NY, USA).

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.4

The results of pion ($\pi^\pm$) production from the CERN synchrocyclotron with ^{12}C beams of 60, 75 and 85 A MeV on ^{7}Li, ^{12}C and ^{208}Pb are investigated theoretically. The energy region is particularly interesting because it lies below the free nucleon-nucleon threshold of 290 MeV for the production of pions. Characteristic features of the data include: a) a smooth fall off of the double differential spectra for all targets, with an absolute cross section $\sim A^{2/3}$; b) a strong beam energy dependence of the absolute $\pi^\pm$ cross sections; and c) an increase in the π^-/π^+ ratio from unity for target nuclei with neutron excess. The authors perform detailed calculations on the basis of an independent nucleon-nucleon scattering model, with a view to establish its predictive capabilities. (2 refs.)

70587 Subthreshold production of neutral pions in heavy ion collisions. E.Grosse, H.Dabrowski, O.Klepper, C.Michel, W.F.J.Muller, H.Steltzer (GSI, Darmstadt, Germany), H.Noll, C.Brendel, W.Rosch, U.Lynen, P.Braun-Munzinger.

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.6

First results are presented for the production of neutral pions produced by ^{12}C ions of 84, 74 and 60 MeV/u furnished by the CERN Synchrocyclotron impinging on targets of C, Al, Ti, Ni, Sn, Ta, Pb and U. (2 refs.)

70588 Backward particle production by protons and ^{12}C nuclei in emulsion at momenta 4.5 GeV/c/A. A.Abdelsalam, M.Sumbera, S.Vokal (Lab. of High Energies, JINR, Dubna, USSR).

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.8

Various characteristics of events giving rise to the pions or protons emerging within the backward hemisphere (relative to the incoming particle) are investigated and compared with those in the forward region. (3 refs.)

70589 Alpha fragment emission in high energy nucleus-nucleus collision. R.Bhanja, N.A.L.Devi, R.R.Joseph, I.D.Ojha, M.Shyam, S.K.Tuli (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.10
The authors report on the α fragment emission in the interaction of ^{14}N with emulsion nuclei at 2.1 GeV/A. The report is based on the event by event analysis with the separation of H, CNO, AgBr targets in a total sample of 1093 interactions collected by the line scanning method in an emulsion stack of Ilford G5 exposed to ^{14}N at Berkeley Bevalac. (4 refs.)

70590 Alpha particle correlations in nucleus-nucleus collisions at relativistic energies. P.L.Jain, M.M.Aggarwal (Dept. of Phys., State Univ. of New York, Buffalo, NY, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.11
The authors used two stacks of Ilford G-5 emulsions exposed to ^{40}Ar and ^{56}Fe beams at ~2 A GeV and ~1 A GeV respectively from the Bevalac at Berkeley, California. Each beam was parallel to the pellicle surfaces. The pellicles were scanned by along-the-track method under high magnification. In the present experiment, they used about 600 primary interactions from ^{40}Ar at high energy and 650 interactions from the ^{56}Fe beam at low energy. From these interactions, they identified and measured very carefully the relativistic α-particles making angles up to 10 and 15 degrees with respect to the beam direction for higher and lower energies respectively. For α-particles, they plotted the polar vs. azimuthal angle in the laboratory system for these two beams. They also show the angular correlation of two or more α-particles produced at these two energies. There is a definite correlation of α-particles produced at small angles which corresponds to the low temperature interactions. (no refs.)

70591 Particle-particle correlation studies for the system $^{14}N+^{159}Tb$ at 12 MeV/A. R.K.Bhowmik, J.van Driel, R.H.Siemssen, P.B.Goldhoorn, S.Gonggrijp, Y.Iwasaki, R.V.F.Janssens, H.Sakai, K.Siwek-Wilczynska, W.A.Sterrenburg, J.Wilczynski (Kernfysisch Versneller Inst., Groningen, Netherlands).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.12
The energy and angular correlations of alpha particles in coincidence with different ejectiles (HI) have been studied for the reaction $^{14}N+^{159}Tb$ at 168 MeV. The ejectiles were detected at a fixed angle $\theta_{HI}=20°$ and the alpha particles were detected in the reaction plane. Coincidences with protons and neutrons have also been measured for the same HI angle. The angular distributions of particle-unbound projectile-like-fragments (PLF) have been investigated in a separate experiment by detecting the decay products in coincidence for varying the PLF emission angle. (2 refs.)

70592 Emission of low-energy light charged-particles in heavy ion reactions at intermediate energies—coincidences with target residues. B.Borderie, J.Galin, M.F.Rivet, I.Forest, R.Bombot, D.Gardes, B.Gatty, D.Guerreau, M.Lefort, H.Oeschler, S.Song, B.Tamain, X.Tarrago (Inst. de Phys. Nucleaire, Orsay, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.13
The emission of light charged-particles in heavy-ion induced reactions is a good probe of the reaction mechanisms. At incident energies below 10 MeV/u there is clear experimental evidence that most of the light particles are due to thermal emission from the compound nucleus or from fully accelerated and equilibrated fragments. In the intermediate energy region the situation is more complicated and particles with velocities strongly connected with the beam velocity are observed. The authors investigate C-induced reactions on a Ni target, at incident energies 30, 60 and 84 MeV/u, and focuses the study on the low energy part of the light charged particle spectra. An inclusive proton spectrum obtained at 90° in the lab system is shown. Measurements were performed in the forward hemisphere from 9 to 90° and the data analyzed in terms of invariant cross sections as a function of parallel and transverse velocities. (3 refs.)

70593 Light particle emission in the reaction $^{93}Nb+^{14}N$ at 132 and ^{208}MeV. T.Fukuda, M.Ishihara, H.Ogata, I.Miura, T.Shimoda, K.Katori, S.Shimoura, M.-K.Tanaka, E.Takada, T.Otsuka (Dept. of Phys., Osaka Univ., Osaka, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.15
The emission of fast light particles such as protons and alpha particles in heavy ion reactions has much attracted current interest because such light particles may probe the early stage of the reaction. The authors report on the emission of fast light particles in the reaction of ^{14}N on ^{93}Nb at 132 and 208 MeV. The experiment was performed at RCNP. The light particles were detected by conventional Si telescope and Si+15 mm High Purity Ge detector telescope. Measured angular range was typically from 8° to 160°. (no refs.)

70594 Light particle emission in α and ^{12}C induced reactions between 25 and 84 MeV/u. R.Glasow, G.Gaul, B.Ludewigt, R.Santo (Inst. fur Kernphys., Univ. Munster, Munster, Germany), H.Ho, W.Kuhn, U.Lynen, W.F.J.Muller.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.16
Spectra of light particles (p,d,t,^3He,α) emissed after bombardment of several targets with ^{12}C ions of 25 and 84 MeV/u (from cyclotron 'VICKSY' (HMI Berlin) and CERN (Geneva)) and α-particles of 25 and 43 MeV/u (from cyclotron 'JULIC', KFA Julich) have been measured at various angles. The spectra display an exponential-like slope and cross sections decreasing with increasing angles. (no refs.)

70595 Light-charged-particle emission as a probe of nucleus-nucleus collisions: identification of emission sources in very-heavy-ion reactions. M.Kaplan, M.Kildir, D.Logan, D.Moses, D.Eriksen (Dept. of Chem., Carnegie-Mellon Univ., Pittsburgh, PA, USA), J.Alexander, D.Guerreau, E.Duek, L.Vaz, N.Agitanand, L.Kowalski, M.Zisman.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.17
The authors have studied the emission of ^4He and ^1H in reactions of ^{40}Ar, ^{56}Fe, ^{86}Kr, and ^{238}U projectiles with several heavy targets at incident energies around 8.5 MeV/u. Using combinations of gas-ionization telescopes, Si detector telescopes, and a position sensitive avalanche detector, two- and three-fold coincidence measurements have been carried out to associate H/He emission with fission and/or deeply inelastic reaction fragments. In some cases, the fission-fragment correlation angle has served as a kinematic constraint to distinguish between fusion-like and inelastic collisions, and to identify the H/He corresponding to these two reaction types. (no refs.)

70596 Light charged particle emission from $^{20}Ne+^{197}Au$. H.Machner (Univ. Bremen, Bremen, Germany), G.Riepe, D.Protic, H.G.Bohlen, G.Fuchs.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.18
The study of light particle emission from heavy-ion induced reactions is a tool to investigate the underlying reaction mechanisms. At energies above the binding energy per nucleon spectra of secondary particles are dominated by preequilibrium emission and projectile break-up. Preequilibrium reactions have been successfully reproduced in light-ion induced reactions in terms of time dependent approaches. However, the situation in heavy-ion induced reactions is not so clear. Thus, have measured spectra of light charged particles ($Z\leq3$, $A\leq10$) over a large energy range. The reaction chosen was $^{197}Au+^{20}Ne$ at 392 MeV bombarding energy. (4 refs.)

70597 Nucleon multiplicity associated with energetic protons from the $^{12}C+^{60}Ni$ reaction. R.L.Robinson, R.L.Auble, J.B.Ball, F.E.Bertrand, R.L.Ferguson, C.B.Fulmer, J.Gomez del Campo, I.Y.Lee, R.W.Novotny, J.C.Wells, G.R.Young (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), C.F.Maguire, H.Yamada.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.20
$Z=1$-7 particles were observed in coincidence with energetic protons ($E_p>15$ MeV) that resulted from bombardment of ^{60}Ni with 191-MeV ^{12}C ions. The coincident particles were detected with 17 ΔE-E telescopes. The total number of nucleons in an event where one particle is a fast proton was deduced from the relation: $N=\Sigma M_iA_i+n+1$, where M_i is the measured multiplicity of particles (integrated over all angles and energies) with mass A_i in coincidence with the energetic protons; n is the number of neutrons which is assumed equal to the number of protons, and the 1 accounts for the gating proton. (1 ref.)

70598 Light charged particle coincidences with heavy fragments for the $^{40}Ar+^{208}Pb$ reaction at 10 MeV/n. J.C.Jacmart, Y.Blumenfeld, N.Frascaria, J.P.Garron, J.C.Roynette, H.Doubre, A.Gamp, E.Plagnol, E.Pollacco (Inst. de Phys. Nucleaire, Orsay, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.21
The angular correlation of light charged particles was measured in coincidence with heavy fragments emitted at a fixed forward angle from the $^{40}Ar+^{208}Pb$ reaction. The experiment was performed by bombarding a 500 $\mu g/cm^2$ ^{208}Pb target evaporated onto a 10 $\mu g/cm^2$ carbon backing with the 396 MeV ^{40}Ar beam from the ALICE accelerator of the Orsay laboratory. Heavy fragment identification was achieved by two different ways using: i) a conventional ΔE-E solid state detector; and ii) a time of flight measurement associated with an ΔE-E detector. The coincident light charged particles were detected over a large angular range in three large area detectors. (3 refs.)

70599 On the energy-distribution of diabatically emitted neutrons in heavy-ion collisions. W.Cassing, A.Lukasiak, W.Norenberg (Gesellschaft fur Schwerionenforschung, Darmstadt, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.23
Diabatic single-particle motion in heavy-ion collision induces highly excited s.p. states due to the direct coupling of the s.p. states to the collective motion. These highly excited states, which essentially have several nodes in the direction of the relative distance between the nuclei and only zero or a single node in the orthogonal direction, decay due to residual two body collisions with width $\Gamma\downarrow$ or due to the coupling to the continuum with width $\Gamma\downarrow$. The latter process is attributed to diabatic emission of protons or neutrons. In order to learn some features about the energy distribution of these light particles the width $\Gamma_\nu^\downarrow(\varepsilon_\nu-\varepsilon_F)$ (which is a function of the s.p. energy ε_ν above the Fermi-energy ε_F) was adopted from Bertsch (1978). The width $\Gamma_\nu^\uparrow(\varepsilon_\nu-E_F-\varepsilon_\nu^s)$, which in addition depends on the experimental separation energy ε_ν^s, was calculated in a two dimensional box model which generated s.p. states of the same nodal structure as the highly excited states in the two-center shell model. For fixed ε_ν the energy distribution $P_\nu^E(\varepsilon)$ then was assumed to be given by a gaussian centered around $\varepsilon_\nu-\varepsilon_F-\varepsilon_\nu^s$ with the width $\Gamma_\nu^\uparrow(\epsilon)$. The decay probability $P\downarrow(t)$ as well as the escape probability $P\uparrow(t)$ and the diabatic s.p. levels $\varepsilon_\nu(t)$ result from the calculations within dissipative diabatic dynamics. Final time integration then yields the differential cross-section dM_n/dE_n for the neutron multiplicity given by $dM_n/dE_n=\Sigma_\nu\int_0^\infty dt\ P_\nu^E(E_n,\ \varepsilon_\nu(t),\ \Gamma_\nu^\downarrow(t)).\ P_\nu^\downarrow(t)P_\nu^\uparrow(t)$. (4 refs.)

70600 Some systematics of total inclusive neutron cross sections for relativistic neon ions. R.Madey, B.D.Anderson, R.A.Cecil, P.C.Tandy (Kent State Univ., Kent, OH, USA), W.Schimmerling.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.24
Based on measurements of the inclusive double differential cross sections for neutron emission from 337 MeV/A Ne reacting in targets of C, Al, Cu, and U, the authors find that the total integrated cross section above a neutron energy T_0 is described well by the formula: $\sigma(T>T_0)=\bar{\sigma}_{NN}(R_G/r_0)^{\alpha(T0)}$, ($r_0=1.2$ fm). Here $\bar{\sigma}_{NN}$ is the isospin-averaged nucleon-nucleon cross section evaluated at an energy equal to the bombarding energy/nucleon, $R_G=r_0(A_p{}^{1/3}+A_T{}^{1/3})/2$, and $\alpha(T_0)$ is obtained from fits to the data. For $T_0=0$, $\alpha=5$. This cross section is always less than that for the primordial neutrons calculated in the participant-spectator model because some primordial neutrons form composite nuclei (e.g. d, t, ^3He, ^4He). For the collision of equal-mass light ($N=A/2$) nuclei, the ratio of the observed to the primordial cross sections is $(\bar{\sigma}_{NN}/\pi r_0{}^2)=0.65$ for $\bar{\sigma}_{NN}$ (337 MeV)=29.4 mb. This ratio is consistent with the cross sections for emission of d, t, and ^3He reported by Nagamiya et al. (1981) for 393 MeV/A Ne on NaF. (8 refs.)

70601 Neutron spectra from 390 and 790 MeV per nucleon Ne on Pb and NaF. R.Madey, B.D.Anderson, A.R.Baldwin, R.A.Cecil, J.C.Varga, J.W.Watson (Kent State Univ., Kent, OH, USA), G.D.Westfall.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.25
The authors have measured neutron time-of-flight spectra at angles of 0°, 15°, 30°, 50°, 70°, 90°, 120°, and 160° from neon ions of 390 and 790 MeV per nucleon at the center of (3.43 g/cm^2) Pb and (2.19 g/cm^2) NaF targets. Flight paths ranged from 8 m at 0° to 3.5 m at 160°. The apparatus measured the time difference between the detection of a neon ion in a beam telescope (consisting of two 0.8 mm scintillators) and the detection of a neutron in one of the eight, mean-timed, neutron counters. The energy resolution varied from 4% at 100 MeV, to 8% at 400 MeV, to 15% at 800 MeV.

Each event was associated with an r-fold ($0 \leq r < 14$) coincidence of charged particles with a 27 MeV threshold for protons. (3 refs.)

70602 Proton source emission in $^{14}N+^{12}C$ at 48 MeV. J.L.Quebert, D.Bertault, M.Boumart, J.N.Scheurer (Centre d'Etudes Nucleaires de Bordeaux-Gradignan, Gradignan, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.30
Central collisions of heavy ions have been extensively studied through inclusive measurements of light particles. The yield of such particles in the so-called midrapidity region of a rapidity plot is usually difficult to probe experimentally because detections near zero degrees are necessary. The authors study a light particle emission in such kinematic conditions in the specific case of a three-body final state. In such a case the light particle is considered as a missing mass in the detection, i.e. there is no need to detect it because a detection of the two remnant nuclei is sufficient. This indirect exclusive measurement is mainly useful when quasi complete correlations are performed; Dalitz plots and rapidity plots can then be deduced. They give an example of such a detection in $^{14}N+^{12}C$, studied with the tandem accelerator of Saclay. The purpose was to observe, by this method, p, d, α or neutrons over a large area of their rapidity plot. Quasi complete in-plane correlations between two heavy fragments were measured with two position sensitive gas telescopes set up on both sides of the beam direction between 19 and 35 degrees. (2 refs.)

70603 Light charged particle emission in 84 MeV/u C induced reactions on Ni. A comparison with an intranuclear cascade model. D.Guerreau, J.Galin, M.F.Rivet, B.Borderie, R.Bimbot, I.Forest, D.Gardes, B.Gatty, M.Lefort, H.Oeschler, S.Song, B.Tamain, X.Tarrago (Inst. de Phys. Nucleaire, Orsay, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.31
Intranuclear cascade (INC) models have been extensively considered in relativistic heavy ion collisions to compare with the experimental data. The range of validity of such models is not well defined, however it is generally thought that the assumptions they imply are fulfilled down to bombarding energies close to 100 MeV/u. The comparison is made on light charged particles arising from the 84 MeV/u C+Ni collisions. For low energy protons it is shown that the cumulated yields of protons emitted in both the cascade step and in the subsequent cooling down of the residual target-like nuclei always exceed the measured ones. The discrepancy is the most sensitive in the forward direction where particles arising from the individual collisions are more abundant than the evaporated ones. Conversely, in the same angular range the emission of α-particles is systematically underestimated. (5 refs.)

70604 Composite fragment production in intermediate energy heavy ion reactions. B.V.Jacak, C.K.Gelbke, L.H.Harwood, W.G.Lynch, D.K.Scott (Nat. Superconducting Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA), T.J.M.Symons, M.B.Tsang, G.D.Westfall.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.32
Inclusive production cross sections of isotopes of hydrogen, helium, lithium, beryllium, and boron have been measured for reactions of 50, 100, and 150 MeV/nucleon argon from the LBL Bevalac with gold and calcium targets. The differential cross sections were measured using three telescopes of solid state detectors, and are fitted with a moving source model to extract temperatures, source velocities and total cross sections in the intermediate rapidity region. This work extends the study of the production of intermediate rapidity light charged particles to heavier emitted fragments. As the study of heavy ion reactions move to intermediate energies where the transient system has excitation comparable to its binding energy, the production of composite fragments becomes important. The system can undergo statistical decay through many exit channels, or may explode at a certain temperature, leading to an increase in the charged particle multiplicity and a drop in the mean emitted fragment mass. (3 refs.)

70605 Low energy particles produced in heavy ion reactions. O.Scholten, H.Kruse, W.A.Friedman (Nat. Superconducting Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.33
Considerable attention has recently been focused on the reaction Ne on U at 400 MeV/N; where it has been suggested that the angular distribution of protons at low energies show evidence for collective phenomena. Coulomb forces and source velocities, however, influence the proton-spectra significantly in this energy regime. The authors present a calculation to show that the data, including side-peak features and neutron/proton ratios is consistent with a schematic model that involves little more than conservation laws, the long range Coulomb force, and a simple geometry based on two sources. (1 ref.)

70606 Inclusive break-up reactions of ^{6}Li at an incident energy of 26 MeV/nucleon. B.Neumann, H.Rebel, H.J.Gils, R.Planeta, J.Buschmann, H.Klewe-Nebenius, S.Zagromski, R.Shyam, H.Machner (Inst. fur Angewandte Kernphys., Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.38
The emission of fast light particles in nuclear reactions between two complex nuclei are characterized by rather large cross sections and unusual shapes of the energy spectra. In addition to complete fusion, which leads to formation of a compound nucleus, and to the emission of particles preceding the compound nucleus equilibration, the break-up of projectiles in the nuclear field has been found to be a dominant reaction channel accounting for a significant fraction of the total reaction cross section of light and heavy ion induced reactions, in particular at energies above 10 MeV/nucleon. The role of break-up reactions for the understanding of charged particle spectra from ^{6}Li-induced nuclear reactions is demonstrated. The authors present the results of systematic measurements of the inclusive double-differential cross sections for emission of light charged particles after bombarding ^{40}Ca by 156 MeV ^{6}Li ions. (3 refs.)

70607 Measurement of 30 MeV/A ^{12}C-induced reactions on ^{12}C, ^{58}Ni and ^{197} Au targets. A.Menchaca-Rocha, M.E.Brandan, M.Buenerd, J.Chauvin, D.Lebrun, P.Martin, P.de Santignon, J.C.Gondrand, I.Dorion, A.Lounis (Inst. des Sci. Nucleaires, Grenoble, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.39
The evolution with energy of the reaction mechanisms induced by light heavy ions in the range 20-86 MeV/A has been one of the motivations for the development of new accelerating machines. The authors present results from the first of such studies performed with the SARA system at Grenoble. The $^{12}C^{6+}$-30 MeV/A beam from SARA, typically 20 nA on target, with energy resolution $\Delta E \simeq 1.5$ MeV (fwhm), was used to bombard ^{12}C, ^{58}Ni and ^{197}Au self-supporting targets. Singles energy spectra and angular distributions ($\theta_{lab}=9°-30°$) of mass-resolved $Z=2-8$ outgoing reaction products were measured using a 100 μm+ 100 μm+ 5 mm solid state telescope. (1 ref.)

70608 Concidence study of ^{16}O projectile fragmentation at 100 MeV/u. J.D.Silk, R.L.Auble, J.B.Ball, F.E.Bertrand, M.E.Brandan, C.C.Chang, G.Ciangaru, A.A.Cowley, A.Guterman, D.L.Hendrie, H.D.Holmgren, I.Y.Lee, A.Menchaca-Rocha, A.C.Mignerey, S.Mills, R.L.Robinson, G.R.Roche, T.J.M.Symons (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.41
In-plane coincidence measurements have been made using an ^{16}O beam incident on a ^{58}Ni target at 100 MeV per nucleon. Analysis of events with peripheral signatures leads to several conclusions: two-body quasielastic breakup of the projectile does not significantly contribute to the cross section. Even when ^{12}C, α or ^{15}N,p coincidences are observed, there is typically on the order of 50 MeV of excitation transferred to the target. This figure is consistent with observations at lower energies. On the other hand, a dominant process involves the coincidence of a heavy beam fragment with fast protons well outside the fragmentation cone. There is, in fact, a large left-right asymmetry in these correlations for proton angles of ±55°. While the authors have not ruled out a kinematic origin for this effect, the fact that it persists for slow ($\leq$50 MeV) alpha particles at ±55° but is not observed at all at backward angles suggests that model calculations (such as angle dependent pre-equilibrium or fireball with shadowing) are in order. Correlations between light ions in the fragmentation region do not factorize. This suggests that in-flight decay of a prefragment is a significant component of the coincidence yield. (no refs.)

70609 Nucleon exchange in ^{56}Fe-induced reactions at 8.3 MeV/nucleon. H.Breuer, A.C.Mignerey (Univ. of Maryland, College Park, MD, USA), V.E.Viola,Jr., K.Kwiatkowski, K.L.Wolf, J.Birkelund, D.Hilscher, J.R.Huizenga, W.U.Schroder, W.Wilcke.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.42
A systematic measurement of projectile-like fragment nuclide distributions has been performed for 8.3 MeV/u ^{56}Fe ions incident on ^{56}Fe, ^{165}Ho, ^{209}Bi and ^{238}U. These studies were performed at the LBL superHILAC with a ΔE-E time-of-flight detector telescope which provided simultaneous Z and A identification with discrete Z and A resolution (<0.8 units). (no refs.)

70610 Dynamical coupling of relative motion, deformations and charge transfer in deep inelastic heavy-ion collisions. P.Frobrich, B.Strack (Han-Meitner-Inst. fur Kernforschung, Berlin, Germany), M.Durand.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.43
A multi-dimensional Fokker-Planck equation including relative motion, quadrupole deformations and charge transfer is derived from Brownian motion theory and solved within the quasi-linear approximation. Besides the usual radial and tangential friction frictional couplings between relative motion and deformation and between the vibrational modes turn out to be important. The authors found a universal parametrization that reproduces at least the rough features of Coulomb-like, focusing and orbiting systems. For the charge transfer they use the theoretical coefficients of Norenberg et al. (1978). (4 refs.)

70611 Multifragmentation in central, intermediate energy heavy ion collisions. B.Jakobsson, G.Jonsson, B.Lindkvist, A.Oskarsson (Dept. of Phys., Univ. of Lund, Lund, Sweden), J.P.Bondorf, I.Mishustin, C.Pethick.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.44
In an emulsion experiment data from central collisions induced by ^{12}C on Ag(Br) are extracted. Small impact parameter events are selected using the multiplicity criterion $N_{ch} \geq 11$. The collision energies are between 55 and 110 MeV per nucleon. The figure shows the charge distribution of all emitted particles in 75 collisions. For $Z \leq 8$ the particle identity is determined directly, while heavy recoil fragment identification in general is obtained by subtracting the sum of identified charges from $Z_{PROC}+Z_{TARG}=53$. (2 refs.)

70612 Charge equilibration for very heavy systems. R.Lucas, A.Gobbi, C.Gregoire, J.V.Kratz, U.Lynen, C.Ngo, A.Olmi, J.Poitou, H.Sann, G.Wirth (CEN Saclay, Gif-sur-Yvette, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.45
The present data are a part of an investigation of charge equilibration process in deep inelastic heavy ion induced reactions. The experiments (Kr+Au 6.5 MeV/A, Pb+Ge 7.5 MeV/A, Xe+Au 6.7 MeV/A) were performed at the UNILAC (GSI, Darmstadt). From the cross sections $d^4\sigma/d\theta dAdZdE$ the authors obtain the angle integrated isotope distribution. (3 refs.)

70613 Effects of the mass fragmentation potential on the mass diffusion phenomena. S.Yamaji, A.Iwamoto, K.Harada, S.Yoshida (Cyclotron Lab., Inst. of Phys. & Chem. Res., Saitama, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.50
The authors report on the analysis of the relaxation phenomena in the mass exchange for the reaction 1280 MeV $^{208}Pb+^{94}Zr$ on the basis of the linear response theory. Such phenomena has been shown to be well reproduced by the theoretical values of mass diffusion coefficients D_A for various reactions. However, the value of D_A calculated for the above reaction is $0.3/(10^{-23}$ sec). The authors solve the three dimensional coupled equations of motion with statistical fluctuations, taking the relative distance, deformation and projectile-like mass number A_1 as collective variables. (4 refs.)

70614 In-beam spectroscopy of $^{101,102,103}Tc$ via massive transfer reactions. D.R.Haenni, R.P.Schmitt, G.Mouchaty, T.T.Sugihara, U.Garg (Cyclotron Inst., Texas A&M Univ., College Station, TX, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.55
Massive transfer reactions can be combined with in-beam γ-ray spectroscopy to study nuclei with conventional fusion reactions. The relatively neutron rich $^{101,102,103}Tc$ isotopes where produced by $^{100}mo(^{7}Li,^{4,5,6}Hexn)$ reactions at 45 MeV. (3 refs.)

70615 Macroscopic and microscopic features of ^{6}Li-light nucleus scattering potentials at $E_{Li}=156$ MeV. S.Micek, H.J.Gils, H.Rebel, Z.Majka (Inst. fur Angwandte Kernphys., Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.63
The investigation of elastic scattering of ^{6}Li projectiles is of considerable interest since there is a change in the character of elastic scattering observed in the transition from light to heavy ions. At higher bombarding energies and light target nuclei nuclear rainbow scattering is observed, a feature, which has been found to lead to an increased sensitivity to the shape of the real potential in the case of α particle scattering. The authors report on studies of elastic scattering of 156 MeV ^{6}Li ions from ^{6}Li and ^{12}C. The experimental differential cross sections are analyzed on the basis of the optical model using various different phenomenological forms of the real part of the potential (including a quasi-model-independent Fourier-Bessel description). Additionally, a possible spin-orbit interaction is considered and the sensitivity of the experimental data to such a term is studied. (1 ref.)

70616 'Absolute' alpha transfer strength with ^{6}Li projectiles and alpha resonance width. M.S.Eswaran, D.R.Chakrabarty (Nuclear Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.65
The transfer of α-particles in (^{6}Li,d) reaction to a nuclear state which can also be formed as a compound nuclear resonance in α-scattering provides a unique basis for testing the reaction theory and DWBA assumption and affords a comparison of 'absolute' α-cluster spectroscopic strength S_α with the α-scattering resonance width Γ_α. The authors have chosen for such a study the case of $^{16}O(^{6}Li,d)^{20}Ne^*$ at $E_{Li}=32$ MeV leading to the 5.782 MeV state of ^{20}Ne which is also excited as an elastic scattering resonance in $^{16}O(\alpha,\alpha)^{16}O$ at E_α(Lab)=1.317 MeV with a measured width of $\Gamma F_\alpha=28\pm3$ eV. (6 refs.)

70617 Excitation of giant resonances by inelastic scattering of 400 MeV ^{16}O. T.P.Sjoreen, F.E.Bertrand, D.Shapira, R.L.Auble, E.E.Gross, D.J.Horen (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.66
Evidence for the exitation of giant multipole resonance has been observed in ^{90}Zr and ^{208}Pb by using inelastic scattering of 400 MeV ^{16}O ions, from the coupled operation of the tandem and cyclotron at the Holifield Heavy-Ion Research Facility. The experiment used solid state telescopes achieving an overall energy resolution of $\sim$500 keV FWHM. The beam contribution to this width is estimated to be about 200 keV. (no refs.)

70618 Study of the gamma decay of states excited via inelastic scattering of alpha and ^{16}O beams. J.P.Sullivan, R.K.Choudhury, U.Garg, L.Adler, J.D.Bronson, P.Gonthier, D.Haenni, Y.-W.Lui, G.Mouchaty, T.Murakami, M.N.Namboodiri, J.B.Natowitz, M.Parkin, R.P.Schmitt, S.Simon, D.H.Youngblood (Cyclotron Inst., Texas A&M Univ., College Station, TX, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.67
A series of measurements of gammas in coincidence with inelastically scattered projectiles have been performed at the Texas A&M cyclotron. The total gamma energy was measured with a high efficiency sixteen segment NaI counter which covered a solid angle of approximately 90% of 4 π. The inelastically scattered projectiles (as well as many other nuclei in the outgoing channel) were detected with a pair of three-element solid state telescopes at lab angles of 12 and 20 degrees. Data were taken with a 100 MeV alpha beam incident on a ^{90}Zr target as well as 180 and 310 MeV ^{16}O beams incident on ^{90}Zr, ^{144}Sm, and ^{154}Sm targets. The results on gamma rays from the decay of excited states in the regions the giant quadrupole resonance (GQR) and the low energy octupole resonance (LEOR) are discussed. (no refs.)

70619 Inelastic scattering of ^{12}C from ^{208}Pb to the second 0^+ state of $^{12}C^*$. R.Shyam, M.A.Nagarajan (SERC, Daresbury Lab., Daresbury, Warrington, England), A.C.Shotter, A.N.Bice, J.Cerny.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.68
Recently experiments performed at the 88″ cyclotron at Berkeley to measure the cross-sections for the inelatic scattering of ^{12}C from ^{208}Pb target exciting the second 0^+ state of ^{12}C, at the incident ^{12}C energies of ^{132}MeV, 187 MeV and 230 MeV are described. (2 refs.)

70620 Mutual inelastic excitations. O.Hansen, P.D.Bond, C.E.Thorn, M.J.LeVine (Brookhaven Nat. Lab., Upton, NY, USA), P.R.Christensen, S.Pontoppidan, F.Videbaek, M.J.Rhoades-Brown, Jiang Cheng-Lie.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.69
Mutual inelastic excitations have studied in the $^{28}Si+^{28}Si$, $^{28}Si+^{60}Ni$, and $^{28}Si+^{208}Pb$ reactions. The ^{28}Si beam was accelerated in the Brookhaven double Tandem facility and the scattered ^{28}Si ions were analyzed in a QDDD spectrometer and detected in a gas proportional focal plane detector. The $^{28}Si+^{28}Si$ reaction was studied at beam energies of ^{151}MeV and ^{180}MeV, the ^{60}Ni case at 140 MeV and ^{208}Pb at 210 MeV. In each case the inelastic scattering spectrum was measured as function of angle, covering an angular range corresponding to values of the elastic cross section from the Rutherford to 10^{-3} of Rutherford (Pb and Ni) or to 10^{-5} of Rutherford for Si. For angles from $\approx10^{-1}$ of Rutherford and forward, the ^{28}Si spectrum was dominated by the elastic peak and the peaks corresponding to excitation of the low-lying collective states (1.78 MeV 2^+ in Si, 1.33 MeV 2^+ in ^{60}Ni, 2.62 MeV 3^- and 4.07 MeV 2^+ in ^{208}Pb). At more backward angles the elastic peaks gradually become weaker than the low-lying collective transitions and the peaks gradually become weaker than the low-lying collective transitions and the mutual excitation of both target and projectile to the lowest collective states begin to take prominence. For $^{28}Si+^{28}Si$, the $2_1^++2_1^+$ and $2_1^++4_1^+$ mutual excitations becomes stronger than the corresponding single excitations at the most backward angles. The absence of strong double excitations of one of the participating nuclei is conspicuous. (2 refs.)

70621 High resolution excitation function measurements and resonant structures in the ^{16}O-^{16}O-system at the Coulomb barrier. W.Bickel, G.Gaul, W.Lahmer, R.Santo (Inst. fur Kernphys., Univ. Munster, Munster, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.70
The energy dependence of elastic ^{16}O-^{16}O scattering and various reaction channels has been investigated by measuring excitation functions in $\Delta E_{CM}=5$ keV to $\Delta E_{CM}=25$ keV steps as well as angular distribution. The measurements have become possible by the high currents (>20 μA) available at the Bochum Dynamitron Tandem Accelerator together with a jet gas target supplying an ^{16}O target of 1-15 $\mu g/cm^2$ equivalent target thickness. The data show strong energy variations even at energies below the Coulomb energy. From the correlations of structures in the excitation functions in different channels as well as the characteristic P_l^2-behaviour of the angular distributions in the $^{16}O(^{16}O,\alpha)^{28}Si$ reaction to a number of final states strong indications for resonant structures have been found and tentative spin assignments have been made. (no refs.)

70622 Spin of the $E_{CM}=30$ MeV intermediate width resonance in $^{12}C+^{12}C$ inelastic scattering. B.R.Fulton, J.S.Lilley (SERC, Daresbury Lab., Warrington, England), T.M.Cormier, P.M.Stwertka.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.71
Studies of the $^{12}C+^{12}C$ system at energies well above the Coulomb barrier have revealed a prominent series of intermediate width structures in the total cross sections for single and mutual excitation of the 2_1^+, 4.43 MeV first molecular rotational band identified at lower energies. Although tentatively identified as the 12^+, 14^+, 16^+ and 18^+ members, no direct spin assignments are available and this is a continuing uncertainty in any attempts at a model description of the resonant reaction mechanism. In a recent series of measurements the authors have investigated to what extent resonant strength also appears in the higher lying inelastic excitations. One feature of these measurements was the unexpected observation of a strong resonance in the yield to the O_2^+, 7.6 MeV state at $E_{CM}=30$ MeV where the supposed 16^+ resonance has been identified in the single and mutual 2_1^+ channels. This observation is particularly interesting since the angular distribution for decay of a resonant state into a spin zero exit channel should exhibit a pure P_J^2 (cosθ) form and this would provide the first direct spin assignment for one of the intermediate width resonances. (2 refs.)

70623 Spin alignment in $^{12}C+^{12}C$ inelastic scattering. W.Trombik, F.Krug, W.Dunnweber, W.Hering, D.Konnerth, R.Singh, W.Trautmann, D.Zeppenfeld (Sektion Phys., Univ. Munchen, Garching, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.73
Using the out-of-plane γ-ray-particle coincidence method the authors have measured the spin alignment with respect to the scattering normal, P_{zz}, of excited $^{12}C(2^+)$ nuclei from $^{12}C+^{12}C$ inelastic scattering in the energy range 16 MeV$\leq E_{cm}\leq$33 MeV. To detect the 4.44 MeV γ-rays two large-volume NaI detectors were used, positioned on either side of the beam with their axes coinciding with the reaction normal. (4 refs.)

70624 Energy dependence of heavy target fragmentation in nucleus-nucleus collisions. W.Loveland (Dept. of Chem., Oregon State Univ., Corvallis, OR, USA), K.Aleklett, P.O.McGaughey, R.H.Kraus,Jr., G.T.Seaborg.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.92
Reports the results of the radiochemical measurements of the yields, average energies and momenta and angular distributions of target fragments produced in the interaction of 12, 18, 45, 84, 94, 107, 250, 400, 1000 and 2100 MeV/u ^{12}C, ^{16}O and ^{20}Ne projectiles, with ^{181}Ta, ^{197}Au and ^{238}U. The average longitudinal momentum transfer, P_{11}^{trans}, leading to the production of light ($24\leq A\leq65$) fragments, fission fragments and spallation products has been deduced from measurements of target fragment recoil properties. (no refs.)

Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received) .... See Entry 69785

Heavy ion collisions. Vol.3 .... See Entry 69804

Evidence for 3p-2h rotational bands in ^{17}O .... See Entry 70436

Study of spin-orbit interaction of ^{13}C and ^{15}N nuclei in ^{14}C induced transfer reactions on ^{138}Ba .... See Entry 70438

Microscopic study of molecular bands and their crossing .... See Entry 70444

Identification of levels in ^{24}Mg populated in the reaction $^{12}C(^{14}Nd,d)^{24}Mg$ .... See Entry 70455

Microscopic potential overlap for (^{7}Li,t) reactions .... See Entry 70456

$\alpha+^{14}C$ dinuclear molecular band in ^{18}O: a new perspective into heavy ion scattering resonant phenomena .... See Entry 70457

Potential pockets in the $^{238}U+^{238}U$ system and their possible consequences .... See Entry 70463

Multiplicity of gamma-ray transitions in the reaction $^{160}Gd(^{16}O,xn)^{176-x}Hf$. I .... See Entry 70484

^{164}Ta, identification of a new isotope .... See Entry 70506

Multiparticle production in hardon-nucleus and nucleus-nucleus collision .... See Entry 70513

Study of three particle correlation in relativistic heavy ion collision .... See Entry 70514

The breakup of spectator residues in relativistic nuclear collisions .... See Entry 70517

Selection of binary and nonbinary heavy ion reactions via particle KX-ray coincidences .... See Entry 70518

Two particle—two hole effects on the mass distributions in deep inelastic heavy ion collisions .... See Entry 70519

The nuclear response and the imaginary potential for nucleus-nucleus collision .... See Entry 70520

About the unified description of elastic and inelastic cross sections in heavy-ion collisions .... See Entry 70521

Methods for the microscopic calculation of the potential overlap in the DWBA description of multiparticle transfer reactions .... See Entry 70522

A phenomenological imaginary part of the optical potential for heavy ions .... See Entry 70524

Microscopic study of $^{16}O+^{15}N$ .... See Entry 70529

On the description of multiplicity distributions in multiple production processes in terms of combinants .... See Entry 70536

Catastrophic destruction of heavy emulsion nuclei induced by fast hadrons .... See Entry 70554

Investigation of linear momentum transfer on the $^{20}Ne+^{197}Au$ system at 30 MeV/A .... See Entry 70635

Strong enhancement of subbarrier fusion due to negative hexadecapole deformation .... See Entry 70637

Neutron-excess dependence of fusion−Ni+Sn .... See Entry 70638

A note on the time scale for fusion of heavy ions .... See Entry 70639

Multistep nature of heavy-ion fusion reactions .... See Entry 70640

Observation of radiative capture in the reaction $^{90}Zr+^{90}Zr$ .... See Entry 70641

25.80 MESON- AND HYPERON-INDUCED REACTIONS AND SCATTERING

70625 Galileo-invariant theory of low energy pion-nucleus scattering. I. Impulse approximation and Fermi motion. R.Mach (Inst. of Nuclear Phys., Czechoslovak, Acad. Sci., Rez, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.549-57 (1983).
The scattering of a particle by a system of bound scatterers is investigated and reasons are given why the optical model and other models based on the standard impulse approximation violate the Galilean invariance. It is shown how this deficiency can be removed. Further, the validity of factorization approximation is studied. It is shown that there exists a unique combination of effective target particle momenta in the initial and final states, which minimizes the error caused by the factorization approximation. (17 refs.)

70626 The role of the Y_1* resonances in the $\bar{K}$-nucleus reactions at medium energies. N.Yamanishi, M.Kimura, Y.Takahashi (Dept. of Phys., Sci. Univ. of Tokyo, Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.535-41 (Feb. 1983).
The authors point out the importance of many-body effects on Y_1* resonances in the reaction $^{12}C(K^-, \pi^-)_\Lambda{}^{12}C^*$ at $p_K=800$ MeV/c by using the isobar-doorway model formulated for $\bar{K}$-nucleus reactions by Kisslinger (1980). The many-body corrections for Y_1*'s in nuclei are parametrized by using the resonance mass shift ΔM and collision-broadening factor β. It is shown that the cross sections calculated in this model tend to approach the observed data with the phenomenological value of ΔM related to the Σ-well depth. (11 refs.)

70627 Further evidence for the EELL effect. B.K.Jennings, N.de Takacsy (TRIUMF, Vancouver, BC, Canada).
Phys. Lett. B (Netherlands), vol.124B, no.5, p.302-4 (5 May 1983).
By looking at the inelastic scattering to the first excited 0^+ state in ^{12}C, it is shown that multiple scattering in the pion-nucleus system is strongly suppressed. (7 refs.)

Ξ hypernuclei .... See Entry 70480

Multiparticle production in hardon-nucleus and nucleus-nucleus collision .... See Entry 70513

Measurement of the polarization parameter P in π^+p elastic scattering in the region of low-lying pion-nucleon resonances .... See Entry 70542

25.85 FISSION REACTIONS

70628 Role of the deformation of multipolarity six in the dynamic description of spontaneous fission. K.Boning, A.Sobiczewski (Inst. for Nuclear Res., Warsaw, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.4, p.287-301 (April 1983).
The role of the deformation of multipolarity six, ϵ_6, in the description of spontaneous-fission half-lives is studied. Doubly even heavy nuclei (Z=92-102) are considered. It is found that inclusion of ϵ_6 may change the half-lives by up to about four orders. The structure of the microscopic inertia (mass) tensor, connected with ϵ_6, is also investigated. Finally, the equilibrium values of ϵ_6 are calculated. It appears that these quantities are of dynamic rather than static nature. (15 refs.)

70629 Fission-fragment kinetic energy and mass distributions for ^{252}Cf spontaneous fission. Bao Zongyu, Han Hongyin, Meng Jiangchen, Huang Shengnian (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).
Chin. Phys. (USA), vol.3, no.1, p.129-36 (Jan.-March 1983). [received: May 1983]
Fission-fragment kinetic energy and mass distributions for ^{252}Cf spontaneous fission were obtained by correlation energy measurements using gold-silicon surface-barrier detectors. The results show that two pronounced shoulders exist on the mass distribution curves in the total kinetic energy region between 200-216 MeV. Each curve might be considered as composed of three components with the peaks located at about 107, 112, and 118 amu. (8 refs.)

70630 The cross-section for the binary and ternary fission of uranium and lead induced by 5.1, 8.8 and 12.7 GeV alpha-particles. Z.Todorovic, R.Antanasijevic (Inst. of Phys., Belgrade, Yugoslavia).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.3, p.341-6 (1 April 1983).
The cross-sections for the binary and ternary fission of U and Pb induced by alpha-particles of energies at 5.1, 8.8 and 12.7 GeV have been determined by using a polycarbonate (makrofol) as a detector of the fission fragments. The values obtained for the cross-sections are discussed and compared with those obtained with high-energy protons. (11 refs.)

70631 Total kinetic energy release and mass distributions in prompt and delayed muon induced fission of ^{238}U. P.David, J.Hartfiel, H.Janszen (Inst. fur Strahlen- & Kernphys., Univ. of Bonn, Bonn, Germany), T.Johansson, J.Konijn, T.Krogulski, T.Mayer-Kuckuk, C.Petitjean, S.Polikanov, H.W.Reist, G.Tibell.
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.161-4 (28 April 1983).
The total kinetic energy release and mass distributions in prompt and delayed muon induced fission of ^{238}U were measured. A yield of prompt symmetric fission ($116 \leq A \leq 122$) of $(0.26 \pm 0.10)\%$ with a peak to valley ratio of 25 in the mass spectrum was observed. A ratio of prompt to delayed fission yields of $(8.8 \pm 0.3)\%$ is deduced. (12 refs.)

70632 Spontaneous fission half-life of ^{242}Cm. K.Raghuraman, N.K.Chaudhuri, A.V.Jadhav, C.K.Sivaramakrishnan, R.H.Iyer (Radiochem. Div., Bhabha Atomic Res. Centre, Trombay, Bombay, India).
Radiochem. & Radioanal. Lett. (Switzerland), vol.55, no.1, p.R114-83002 (17 Dec. 1982).
The spontaneous fission half-life of ^{242}Cm has been measured using solid state nuclear track detectors. ^{242}Cm was prepared by neutron irradiation of ^{241}Am, purified by using a rigorous ion-exchange procedure and assayed by alpha counting. The fission rate was measured by recording fission fragments in Lexan plastic detectors from planchetted sources of ^{242}Cm, for a known length of time and counting the total number of tracks registered. The measured spontaneous fission half-life is $(7.15 \pm 0.15) \times 10^6$ years, and is compared with the values reported in the literature. (11 refs.)

70633 Mass distributions of fission fragments emitted by highly excited nuclei. L.N.Andronenko, A.A.Kotov, M.M.Nesterov (Leningrad Nuclear Phys. Inst., Gatchina, USSR), W.Neubert, N.A.Tarasov, L.A.Vaishnene.
Z. Phys. A (Germany), vol.310, no.4, p.347-8 (1983).
The mass distribution of fission fragments emitted by highly excited nuclei have been investigated for the determination of some peculiarities of the fission process. It has been shown that the fragment mass distributions obtained by the time-of-flight method change their character in the region of Ag, as expected in the liquid drop model. The cascade-evaporation model and the statistical method of Fong (1978) describe the experimental data with a good accuracy. (8 refs.)

70634 Fission yields of In isotopes in the thermal neutron fission of ^{235}U. M.Shmid, G.Engler (Soreq Nuclear Res. Centre, Yavne, Israel).
Z. Phys. A (Germany), vol.311, no.1-2, p.113-16 (1983).
Fission yields of $^{124\text{-}132}In$ in the thermal neutron fission of ^{235}U were determined for the first time. Charge displacements $\Delta Z = Z_p - Z_{UCD}$ were calculated for the corresponding mass chains. Both fission yields and charge displacement values were compared with those obtained by systematics by Wahl et al. (1969) and Wolfsberg (1974). It was found that the fission yields of the In isotopes obey the Gaussian distribution. The displacement function of Wolfsberg seems to give the better representation of the experimental results. Half-lives of $^{124\text{-}131}In$ were determined from beta decay curves. (12 refs.)

70635 Investigation of linear momentum transfer on the $^{20}Ne+^{197}Au$ system at 30 MeV/A. G.Nebbia, E.Tomasi, C.Ngo, X.S.Chen, G.La Rana, S.Leray, P.Lhenoret, R.Lucas, C.Mazur, M.Ribrag (DPh-N/MF, CENS, Gif-sur-Yvette, France), C.Cerruti, S.Chiodelli, A.Demeyer, D.Guinet, J.L.Charvet, M.Morjean, Y.Pranal, A.Peghaire, L.Sinopoli, J.Uzureau, R.de Swiniarski.
Z. Phys. A (Germany), vol.311, no.3, p.247-8 (1983).
The authors have deduced the linear momentum transferred from the projectile to the fissioning nucleus in the reaction $^{20}Ne+^{197}Au$ at 30 MeV/A by measuring the folding angle between the two fission fragments. They found that the most probable linear momentum transfer represents 76% of the initial value. (2 refs.)

70636 Heavy nuclei disintegration mechanisms by 1 GeV protons. Yu.A.Chestnov, B.L.Gorshkov, A.I.Iljin, B.Yu.Sokolovski, G.E.Solyakin (Leningrad Nuclear Phys. Inst., Gatchina, USSR).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.26
It is known, that the irradiation of heavy nuclei by relativistic protons leads to nuclear fission with large cross section. This process is accompanied by different nucleon losses. The value of nucleon losses may serve as an important criterion for various disintegration mechanisms of heavy nuclei. A two-arm time-of-flight mass spectrometer with independent start-signal pickup, which allows nucleon loss measurements, has been employed for the investigation of heavy nuclei disintegration by 1 GeV protons. The collinear geometry of the flight paths perpendicular to the beam direction has made it possible to choose events with small longitudinal transferred momentum. The fragment sum mass distribution for ^{238}U, ^{232}Th, ^{197}Au and ^{184}W target nuclei are shown. (1 ref.)

A compilation of resonance integrals from hydrogen to fermium .... See Entry 69798

Energy dependence of heavy target fragmentation in nucleus-nucleus collisions .... See Entry 70624

^{252}Cf plasma desorption in ion implanted mica .... See Entry 73389

25.88 FUSION REACTIONS

70637 Strong enhancement of subbarrier fusion due to negative hexadecapole deformation. M.J.Rhoades-Brown (Phys. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), V.E.Oberacker.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1435-8 (9 May 1983).
Within a modified barrier penetration model the fusion cross section for ${}_8^{16}O+{}_{74}^{184}W$ is calculated at subbarrier energies. It is shown that nuclei with positive quadrupole moments and large negative hexadecapole moments have enhanced fusion cross sections over elongated systems only. Fusion measurements with such systems will provide a definitive answer to the question of deformation effects on subbarrier fusion. (11 refs.)

70638 Neutron-excess dependence of fusion−Ni+Sn. W.S.Freeman, H.Ernst, D.F.Geesaman, W.Henning, T.J.Humanic, W.Kuhn, G.Rosner, J.P.Schiffer, B.Zeidman (Argonne Nat. Lab., Argonne, IL, USA), F.W.Prosser.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1563-6 (16 May 1983).
Excitation functions (E_{lab}=235-320 MeV) for producing nuclei close to the compound system (evaporation residues) were measured for $^{58,64}Ni+^{112\text{-}124}Sn$, corresponding to a 20% variation in the compound-nucleus neutron number. A dramatic, order-of-magnitude increase was observed in the maximum cross section as a function of the compound-nucleus neutron excess. The subbarrier energy dependence of the cross sections is well described by an optical-model calculation, but not by the frequently used parabolic approximation. (14 refs.)

70639 A note on the time scale for fusion of heavy ions. P.Braun-Munzinger, G.M.Berkowitz (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.19-21 (19 May 1983).
The reaction time for fusion of heavy ions is estimated in a simple barrier penetration model. Within this model the relevant time scale is obtained from the time 'delay' corresponding to tunneling through the interaction barrier. This time delay is estimated to be comparable or shorter than the travel time for the same distance when no barrier is present. This implies that high lying collective modes might influence the fusion process. (16 refs.)

70640 Multistep nature of heavy-ion fusion reactions. O.Civitarese, B.V.Carlson, M.S.Hussein, A.Szanto de Toledo (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Phys. Lett. B (Netherlands), vol.125B, no.1, p.22-4 (19 May 1983).
A systematic analysis of available light- and intermediate-heavy-ion fusion cross section data within the Statistican Yrast Line Model is performed. The intrinsic excitation energy needed for fusion to occur is found to depend linearly on the mass of the compound system. An interpretation of this dependence in terms of multistep processes is suggested. (15 refs.)

70641 Observation of radiative capture in the reaction $^{90}Zr+^{90}Zr$. J.G.Keller, H.-G.Clerc, K.-H.Schmidt, Y.K.Agarwal, F.P.Hessberger (Gesellschaft fur Schwerionenforschung mbH, Darmstadt, Germany), R.Hingmann, G.Munzenberg, W.Reisdorf, C.C.Sahm.
Z. Phys. A (Germany), vol.311, no.3, p.243-4 (1983).
Describes the radiative capture of a heavy ion in the reaction $^{90}Zr(^{90}Zr,\gamma)$ and predicts the fusion barrier. The evaporation residues were examined and the deexcitation channels identified by their subsequent α-decay. (7 refs.)

70642 Pionic fusion—an example of a coherent nuclear collision. K.Klingenbeck, R.Hupke, M.G.Huber (Inst. for Theoretical Phys., Univ. of Erlangen, Erlangen, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.5
In contrast to highly inclusive reactions which dominate nuclear collisions at intermediate energies the authors consider a rare process where two nuclei form a bound state $1\nu>$ of the united nucleus B; the total free energy of the system is carried away by a pion: $A_1+A_2 \rightarrow B\ (z\pm1,\ N\mp1)+\pi^{\mp}$. The analysis of such an exclusive reaction leads to two classes of rather unconventional questions concerning the reaction mechanism and the spectroscopic structure of the nuclei involved, respectively: (i) How can the thermalisation of the energy be avoided? Evidently, the total kinetic energy of the entrance channel is transferred to a single degree of freedom, the pionfield. (ii) Which states $|B_\nu>$ are excited by a given entrance channel fragmentation? This is related to the spectroscopic parentage between the state $1\nu>$ and the corresponding target projectile combination $|A_1A_2>$. From present understanding of these reactions the authors deduce the following conclusions: (i) the reaction is highly selective: the cross section depends sensitively on the spectroscopic decomposition of the state $|B_\nu>$; depending on the target projectile fragmentation the forward cross section for light ions may vary near threshold from 10 pb/sr to 100 nb/sr; (ii) the excitation of the high spin members of a given dinuclear structure is particularly favoured as a result of the strong kinematical mismatch; (iii) the reaction can be used for the ultracold production of new isotopes. (3 refs.)

Charge transfer prior to fusion .... See Entry 70580

27.00 PROPERTIES OF SPECIFIC NUCLEI LISTED BY MASS RANGES

27.10 $A \leq 5$

Mass number dependence of large transverse momentum production and massive lepton pair production: effects of multi-quark clusters on high energy reactions off nuclear targets .... See Entry 70343

Electron scattering from nuclear targets and quark distributions in nuclei .... See Entry 70394

P-odd effects in the deuteron electrodisintegration $e+d \rightarrow e^-+n+p$ .... See Entry 70395

The parity violating rotation of the neutron spin in helium .... See Entry 70450

Axial meson exchange current effects in deuterium in the current algebra approximation .... See Entry 70458

Ξ hypernuclei .... See Entry 70480

Is the neutrino mass equal to 34 eV?—A discussion of the atomic effect in the β-decay of ^3H .... See Entry 70503

On the polarisation and interference phenomena in the process of electrospallation of a deuteron .... See Entry 70531

Spin-spin correlations and spin-asymmetries for the reaction $p\bar{p} \rightarrow pn\pi^+$ at 510 MeV .... See Entry 70539

Measurement of the polarization parameter P in π^+p elastic scattering in the region of low-lying pion-nucleon resonances .... See Entry 70542

The $^3He(\gamma,2p)n$ reaction for $E_\gamma=80\text{-}170$ MeV .... See Entry 70543

Estimate of the error of solving the integral equation with the local potential for scattering of a nucleon by a deuteron .... See Entry 70547

The proton-deuteron scattering lengths .... See Entry 70551

Carbon and deuterium nuclear scattering of 48.5 MeV protons .... See Entry 70553

Some problems in the microscopic theory for the interaction of complex nuclei .... See Entry 70559

27.20 $6 \leq A \leq 19$

Evidence for 3p-2h rotational bands in ^{17}O .... See Entry 70436

Observations of large differences between mass and charge excitation of collective states .... See Entry 70443

Microscopic study of molecular bands and their crossing .... See Entry 70444

Microscopic potential overlap for (^{7}Li,t) reactions .... See Entry 70456

$\alpha+^{14}C$ dinuclear molecular band in ^{18}O: a new perspective into heavy ion scattering resonant phenomena .... See Entry 70457

Ξ hypernuclei .... See Entry 70480

A phenomenological imaginary part of the optical potential for heavy ions .... See Entry 70524

Microscopic study of $^{16}O+^{15}N$ .... See Entry 70529

Investigation of the mechanism of the (^{3}He,α) reaction of the ^{13}C nucleus .... See Entry 70530

The theory of electron-scattering coincidence experiments .... See Entry 70544

Electron scattering from ^{13}C .... See Entry 70545

Calculation of the cross section of the $^6Li(n,nd)^4He$ reaction with the cluster wave functions of the ^6Li nucleus .... See Entry 70546

Relativistic impulse approximation for *p*-nucleus elastic scattering .... See Entry 70550

Polarization in inclusive scattering of protons from nuclei at 1 GeV .... See Entry 70552

Carbon and deuterium nuclear scattering of 48.5 MeV protons .... See Entry 70553

Elastic backscattering cross sections of protons on oxygen .... See Entry 70555

Elastic scattering of high energy alpha-particles on nuclei .... See Entry 70557

Measurement of cross-sections and analysing powers for the break-up of polarised ^3He .... See Entry 70563

Molecular resonances and spin alignment in $^{12}C+^{16}O$ inelastic scattering .... See Entry 70574

Pion production by 86 MeV/nucleon ^{12}C ions on nuclei .... See Entry 70584

Pion production below the free nucleon-nucleon threshold in heavy-ion reactions .... See Entry 70586

Subthreshold production of neutral pions in heavy ion collisions .... See Entry 70587

Some systematics of total inclusive neutron cross sections for relativistic neon ions .... See Entry 70600

Proton source emission in $^{14}N+^{12}C$ at 48 MeV .... See Entry 70602

Measurement of 30 MeV/A ^{12}C-induced reactions on ^{12}C, ^{58}Ni and ^{197} Au targets .... See Entry 70607

'Absolute' alpha transfer strength with ^6Li projectiles and alpha resonance width .... See Entry 70616

Inelastic scattering of ^{12}C from ^{208}Pb to the second 0^+ state of $^{12}C^*$ .... See Entry 70619

High resolution excitation function measurements and resonant structures in the $^{16}O\text{-}^{16}O$-system at the Coulomb barrier .... See Entry 70621

Spin of the $E_{CM}=30$ MeV intermediate width resonance in $^{12}C+^{12}C$ inelastic scattering .... See Entry 70622

Spin alignment in $^{12}C+^{12}C$ inelastic scattering .... See Entry 70623

The role of the Y_1^* resonances in the $\bar{K}$-nucleus reactions at medium energies .... See Entry 70626

Further evidence for the EELL effect .... See Entry 70627

27.30 $20 \leq A \leq 38$

Centroids and widths in the symplectic collective model .... See Entry 70434

Microscopic study of molecular bands and their crossing .... See Entry 70444

Electroexcitation of 2^+ and 4^+ states in ^{28}Si: a test of the renormalized shell model .... See Entry 70449

Shell-model relationships between negative-parity states of even-mass $A=30\text{-}40$ nuclei .... See Entry 70454

Identification of levels in ^{24}Mg populated in the reaction $^{12}C(^{14}Nd,d)^{24}Mg$ .... See Entry 70455

Ξ hypernuclei .... See Entry 70480

Spins and parities of the resonance states of ^{24}Mg which are excited in the $^{23}Na(p,\alpha)^{20}Ne$ and $^{23}Na(p,p_h)^{23}Na^*$ reactions for $E_p=6.27$, 6.37 and 6.52 MeV .... See Entry 70525

Polarization in inclusive scattering of protons from nuclei at 1 GeV .... See Entry 70552

Measurement of cross-sections and analysing powers for the break-up of polarised ^3He .... See Entry 70563

Light fragment emission in the model of transport theory for high-energy nucleus-nucleus collisions .... See Entry 70569

Statistical analysis of the elastic and inelastic scattering of $^{12}C+^{28}Si$ and $^{16}O+^{28}Si$ .... See Entry 70579

Pion production by 86 MeV/nucleon ^{12}C ions on nuclei .... See Entry 70584

Subthreshold production of neutral pions in heavy ion collisions .... See Entry 70587

Some systematics of total inclusive neutron cross sections for relativistic neon ions .... See Entry 70600

Neutron spectra from 390 and 790 MeV per nucleon Ne on Pb and NaF .... See Entry 70601

'Absolute' alpha transfer strength with ^6Li projectiles and alpha resonance width .... See Entry 70616

Mutual inelastic excitations .... See Entry 70620

High resolution excitation function measurements and resonant structures in the $^{16}O\text{-}^{16}O$-system at the Coulomb barrier .... See Entry 70621

27.40 $39 \leq A \leq 58$

Observations of large differences between mass and charge excitation of collective states .... See Entry 70443

Shell-model relationships between negative-parity states of even-mass $A=30\text{-}40$ nuclei .... See Entry 70454

γ-decay of the states of $^{55,56}Fe$ excited in the (n,xnγ) reaction on ^{56}Fe at $E_n=14.6$ MeV .... See Entry 70482

Statistical properties of $3/2^+$ resonances in ^{49}V .... See Entry 70528

Relativistic impulse approximation for *p*-nucleus elastic scattering .... See Entry 70550

Elastic scattering of high energy alpha-particles on nuclei .... See Entry 70557

Pre-equilibrium and knock-out processes in (α,2α) reactions .... See Entry 70562

Measurement of cross-sections and analysing powers for the break-up of polarised ^3He .... See Entry 70563

Light fragment emission in the model of transport theory for high-energy nucleus-nucleus collisions .... See Entry 70569

Single nucleon transfer reactions in a core excitation model for ^{48}Ti incident on ^{42}Ca at 8 MeV/amu .... See Entry 70572

A pion interferometry study of 1.5 GeV/A Ar-KCl collisions .... See Entry 70585

Subthreshold production of neutral pions in heavy ion collisions .... See Entry 70587

Emission of low-energy light charged-particles in heavy ion reactions at intermediate energies—coincidences with target residues .... See Entry 70592

Light charged particle emission in 84 MeV/u C induced reactions on Ni. A comparison with an intranuclear cascade model .... See Entry 70603

Composite fragment production in intermediate energy heavy ion reactions .... See Entry 70604

Inclusive break-up reactions of ^6Li at an incident energy of 26 MeV/nucleon .... See Entry 70606

Measurement of 30 MeV/A ^{12}C-induced reactions on ^{12}C, ^{58}Ni and ^{197} Au targets .... See Entry 70607

Concidence study of ^{16}O projectile fragmentation at 100 MeV/u ... See Entry 70608

Nucleon exchange in ^{56}Fe-induced reactions at 8.3 MeV/nucleon ... See Entry 70609

27.50 59 ≤ A ≤ 89

Structure of the excited states of the odd isotopes of bromine ^{75,77,79,81,83}Br ... See Entry 70428

The interacting boson model in the germanium region ... See Entry 70435

Observations of large differences between mass and charge excitation of collective states ... See Entry 70443

Observation and mass measurement of ^{69}Ni ... See Entry 70445

The 8^+ levels of ^{86}Zr revisited ... See Entry 70453

Disproof of the alleged two-phonon character of the 0_2^+ state in ^{64}Zn ... See Entry 70488

The Irvine ^{82}Se experiments ... See Entry 70496

Early results from the Battelle-Carolina ^{76}Ge double beta decay project ... See Entry 70497

The status of the UCSB-LBL ^{76}Ge double beta decay experiment ... See Entry 70498

Recent results obtained in the Mt. Blanc experiment on $\beta\beta$ decay of ^{76}Ge ... See Entry 70499

Optimization of irradiation parameters for ^{67}Ga production from ^{nat}Zn(p,xn) nuclear reactions ... See Entry 70548

Polarization in inclusive scattering of protons from nuclei at 1 GeV ... See Entry 70552

Catastrophic destruction of heavy emulsion nuclei induced by fast hadrons ... See Entry 70554

Light ion induced Hanbury-Brown Twiss proton correlations near the Fermi energy ... See Entry 70561

Coulomb nuclear interference effects in the elastic and inelastic scattering of ^{16}O and ^{18}O ions on ^{70}Ge ... See Entry 70577

A pion interferometry study of 1.5 GeV/A Ar-KCl collisions ... See Entry 70585

Subthreshold production of neutral pions in heavy ion collisions ... See Entry 70587

Emission of low-energy light charged-particles in heavy ion reactions at intermediate energies—coincidences with target residues ... See Entry 70592

Nucleon multiplicity associated with energetic protons from the ^{12}C+^{60}Ni reaction ... See Entry 70597

Some systematics of total inclusive neutron cross sections for relativistic neon ions ... See Entry 70600

Light charged particle emission in 84 MeV/u C induced reactions on Ni. A comparison with an intranuclear cascade model ... See Entry 70603

Mutual inelastic excitations ... See Entry 70620

27.60 90 ≤ A ≤ 149

Investigation of the decay of oriented ^{145}Eu nuclei ... See Entry 70426

Investigation of the decay of oriented ^{147}Eu nuclei ... See Entry 70427

Study of spin-orbit interaction of ^{13}C and ^{15}N nuclei in ^{14}C induced transfer reactions on ^{138}Ba ... See Entry 70438

Shell model studies of very neutron deficient Ru and Rh nuclei ... See Entry 70440

High spin states and discrete line spectroscopy of ^{128}ce ... See Entry 70441

High spin states in ^{129}Ce ... See Entry 70442

Deformation correlation effects in the ^{154}Sm-^{144}Sm neutron density difference ... See Entry 70447

Level structure of ^{106}Mo ... See Entry 70452

Angular distributions of γ-quanta from the ^{93}Nb(n,n′γ) reaction ... See Entry 70483

Nuclear orientation of ^{147}Tb ($T_{1/2}$=1.7h), ^{149}Tb ($T_{1/2}$=4.15 h) and ^{151}Tb ($T_{1/2}$=17.7 h) in a gadolinium host ... See Entry 70485

γ-radiation in the reaction ^{143}Nd (n,n′γ) using fast neutrons from a reactor ... See Entry 70486

Decay properties of low-lying levels in ^{100}Rh ... See Entry 70490

Double beta decay, massive neutrinos and lepton conservation ... See Entry 70493

The 1^-(1.9 MeV β^-)2^+ transition in the decay of ^{148}Pm ... See Entry 70505

Catastrophic destruction of heavy emulsion nuclei induced by fast hadrons ... See Entry 70554

Shadowing of α-emitting fragments observed in 313 MeV ^{32}S+^{93}Nb collisions ... See Entry 70575

Moments of charge distributions in the reaction ^{92}Mo+^{92}Mo at 14.7 MeV/u ... See Entry 70576

Products of $3 \leq Z \leq 9$ from long-lived intermediates in the reactions 336 MeV ^{40}Ar+Ag, ^{154}Sm and Au ... See Entry 70578

Pion production by 86 MeV/nucleon ^{12}C ions on nuclei ... See Entry 70584

Subthreshold production of neutral pions in heavy ion collisions ... See Entry 70587

Light particle emission in the reaction ^{93}Nb+^{14}N at 132 and ^{208}MeV ... See Entry 70593

Multifragmentation in central, intermediate energy heavy ion collisions ... See Entry 70611

In-beam spectroscopy of ^{101,102,103}Tc via massive transfer reactions ... See Entry 70614

Excitation of giant resonances by inelastic scattering of 400 MeV ^{16}O ... See Entry 70617

Study of the gamma decay of states excited via inelastic scattering of alpha and ^{16}O beams ... See Entry 70618

Fission yields of In isotopes in the thermal neutron fission of ^{235}U ... See Entry 70634

Neutron-excess dependence of fusion—Ni+Sn ... See Entry 70638

Observation of radiative capture in the reaction ^{90}Zr+^{90}Zr ... See Entry 70641

In situ neutron activation analysis of and the neutron capture cross-section for ^{90}Sr$^+$ ... See Entry 73385

27.70 150 ≤ A ≤ 189

Excitation of the collective states of nuclei of the transitional region having A≈190 to 200 for inelastic scattering of low-energy neutrons ... See Entry 70429

Identification of single-particle configurations at very high spin in $^{150-152}$Dy ... See Entry 70431

Yrast-Yrare interaction in Os nuclei ... See Entry 70432

Deformation correlation effects in the ^{154}Sm-^{144}Sm neutron density difference ... See Entry 70447

The quadrupole moment of ^{176}Lu ... See Entry 70451

Multiplicity of gamma-ray transitions in the reaction ^{160}Gd(^{16}O,xn)$^{176-x}$Hf. I ... See Entry 70484

Nuclear orientation of ^{147}Tb ($T_{1/2}$=1.7h), ^{149}Tb ($T_{1/2}$=4.15 h) and ^{151}Tb ($T_{1/2}$=17.7 h) in a gadolinium host ... See Entry 70485

The γ-spectrum of ^{156}Gd from the inelastic scattering of fast neutrons ... See Entry 70487

Combined analysis of inelastic electron-scattering and muonic-atom hyperfine-splitting data: an application to ^{152}Sm ... See Entry 70489

The interacting boson model applied to the mercury isotopes ... See Entry 70492

Investigation of the decay of ^{165}Tm→^{165}Er ... See Entry 70500

Investigation of K X-rays which accompany the decay of ^{168}Tm→^{168}Er ... See Entry 70502

^{164}Ta, identification of a new isotope ... See Entry 70506

Identification of the proton drip line ... See Entry 70507

Gamma-ray polarization and nuclear orientation measurements on ^{182}TaFe ... See Entry 70541

On the suppression of multiple rotational excitation in heavy ion inelastic scattering above the Coulomb barrier ... See Entry 70573

Products of $3 \leq Z \leq 9$ from long-lived intermediates in the reactions 336 MeV ^{40}Ar+Ag, ^{154}Sm and Au ... See Entry 70578

Neutral strange particles and π^0 production in the collisions of d and ^{12}C with Ta at 4.2 GeV/c/N momentum ... See Entry 70583

Subthreshold production of neutral pions in heavy ion collisions ... See Entry 70587

Particle-particle correlation studies for the system ^{14}N+^{159}Tb at 12 MeV/A ... See Entry 70591

Nucleon exchange in ^{56}Fe-induced reactions at 8.3 MeV/nucleon ... See Entry 70609

Study of the gamma decay of states excited via inelastic scattering of alpha and ^{16}O beams ... See Entry 70618

Energy dependence of heavy target fragmentation in nucleus-nucleus collisions ... See Entry 70624

Heavy nuclei disintegration mechanisms by 1 GeV protons ... See Entry 70636

The generator production of ^{172}Lu from ^{172}Hf for limited nuclear medicine research ... See Entry 73664

27.80 190 ≤ A ≤ 219

Excitation of the collective states of nuclei of the transitional region having A≈190 to 200 for inelastic scattering of low-energy neutrons ... See Entry 70429

U(6/12) supersymmetries in nuclei ... See Entry 70433

Non local effects induced by the particle-vibration coupling ... See Entry 70439

The interacting boson model applied to the mercury isotopes ... See Entry 70492

Identification of the proton drip line ... See Entry 70507

Spreading width of Gamow-Teller resonances in ^{208}Bi ... See Entry 70526

Polarization in inclusive scattering of protons from nuclei at 1 GeV ... See Entry 70552

On the spin-dependence of transfer channel coupling in sub-coulomb deuteron scattering ... See Entry 70556

***D*-state and multistep effects in (α,*d*) reactions** ... See Entry 70558

Products of $3 \leq Z \leq 9$ from long-lived intermediates in the reactions 336 MeV ^{40}Ar+Ag, ^{154}Sm and Au ... See Entry 70578

Pion production by 86 MeV/nucleon ^{12}C ions on nuclei ... See Entry 70584

Pion production below the free nucleon-nucleon threshold in heavy-ion reactions ... See Entry 70586

Subthreshold production of neutral pions in heavy ion collisions ... See Entry 70587

Light charged particle emission from ^{20}Ne+^{197}Au ... See Entry 70596

Light charged particle coincidences with heavy fragments for the ^{40}Ar+^{208}Pb reaction at 10 MeV/n ... See Entry 70598

Neutron spectra from 390 and 790 MeV per nucleon Ne on Pb and NaF ... See Entry 70601

Composite fragment production in intermediate energy heavy ion reactions ... See Entry 70604

Measurement of 30 MeV/A ^{12}C-induced reactions on ^{12}C, ^{58}Ni and ^{197} Au targets ... See Entry 70607

Nucleon exchange in ^{56}Fe-induced reactions at 8.3 MeV/nucleon ... See Entry 70609

Charge equilibration for very heavy systems ... See Entry 70612

Effects of the mass fragmentation potential on the mass diffusion phenomena ... See Entry 70613

Excitation of giant resonances by inelastic scattering of 400 MeV ^{16}O ... See Entry 70617

Inelastic scattering of ^{12}C from ^{208}Pb to the second 0^+ state of ^{12}C* ... See Entry 70619

Mutual inelastic excitations ... See Entry 70620

Energy dependence of heavy target fragmentation in nucleus-nucleus collisions ... See Entry 70624

Investigation of linear momentum transfer on the $^{20}Ne+^{197}Au$ system at 30 MeV/A .... See Entry 70635

Heavy nuclei disintegration mechanisms by 1 GeV protons ......See Entry 70636

27.90 220 ≤ A

Potential pockets in the $^{238}U+^{238}U$ system and their possible consequences ....See Entry 70463

On the neutron excess ($N-Z$) and a periodic table for atomic nuclei ....See Entry 70464

Subthreshold production of neutral pions in heavy ion collisions ....See Entry 70587

Some systematics of total inclusive neutron cross sections for relativistic neon ions .... See Entry 70600

Nucleon exchange in ^{56}Fe-induced reactions at 8.3 MeV/nucleon ....See Entry 70609

Energy dependence of heavy target fragmentation in nucleus-nucleus collisions ....See Entry 70624

Role of the deformation of multipolarity six in the dynamic description of spontaneous fission ....See Entry 70628

Fission-fragment kinetic energy and mass distributions for ^{252}Cf spontaneous fission .... See Entry 70629

The cross-section for the binary and ternary fission of uranium and lead induced by 5.1, 8.8 and 12.7 GeV alpha-particles .... See Entry 70630

Total kinetic energy release and mass distributions in prompt and delayed muon induced fission of ^{238}U ....See Entry 70631

Spontaneous fission half-life of ^{242}Cm ....See Entry 70632

Fission yields of In isotopes in the thermal neutron fission of ^{235}U ....See Entry 70634

Heavy nuclei disintegration mechanisms by 1 GeV protons ......See Entry 70636

^{252}Cf plasma desorption in ion implanted mica ....See Entry 73389

28.00 NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

(see also 86.10 Energy resources and their utilisation)

28.20 NEUTRON PHYSICS

(see also 25.40 Nucleon-induced reactions and scattering)

70643 Thermal neutron extrapolation distances for slabs of beryllium and water. P.Mohan, R.Mohan, F.Ahmed, L.S.Kothari (Dept. of Phys. & Astrophys. Univ. of Delhi, Delhi, India).
J. Phys. D (GB), vol.16, no.5, p.715-22 (14 May 1983).
Extrapolation distances for thermal neutrons have been obtained for slabs of beryllium and light water by minimising the difference between the steady-state leakage spectra calculated on the basis of diffusion and transport theories. Using the present values of extrapolation distance ensure that neutron spectra (both in beryllium and water) calculated on the basis of diffusion theory agree well with the corresponding transport theory spectra, even at distances close to the free surface. The authors find the extrapolation distance to be dependent of the thickness of the slab, increasing with increase in the thickness. (19 refs.)

An evaluation of approximate methods for calculating anisotropic flux escape and transmission probabilities for cylindrical annular regions ..See Entry 70708

28.41 FISSION REACTOR THEORY AND DESIGN

70644 Analysis of natural convection using penalty finite elements: laminar flow analysis and turbulent flow analysis by mixing length theory. Y.Eguchi, G.Yagawa, Y.Miyauchi, M.Masuda.
J. At. Energy Soc. Jpn. (Japan), vol.25, no.2, p.133-9 (Feb. 1983). In Japanese.
An application of the penalty finite element method to incompressible viscous flows is studied. The authors applied this method to a typical flow problem of the transient natural convection. Since, in this method, it is not necessary to deal with the incompressibility constraint and pressure can be eliminated from the equation systems, the computational efforts are considerably reduced. This method is proved to be effective in the case of the natural convection analysis. They also analyze the turbulent flows with the simple method using the Prandtl's mixing length theory. The numerical results show good agreements with experimental as well as theoretical values. (17 refs.)

70645 Application of the ASME-code-case N 47 to a typical thick-walled HTR-component made of Incoloy 800. F.Kemter, A.Schmidt (Hochtemperatur-Reaktorbau GmbH, Mannheim, Germany).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.2/1-21 In German.
Since HTR plants operate at temperatures above 500 deg.C, the materials for various components must be chosen with regard not only to fatigue but also to creep properties and inelastic expansions. The ASME-High Temperature CCN47-Code gives a safe guide but experience has shown that it may in some cases lead to over-design. A curve gives creep characteristics of Incoloy 800 as a function of time at a pressure of 200N/mm^2. Sketches of the range of plastic, cyclic-plastic deformations, transients and load histograms are given. (no refs.) *G.R.S.*

70646 Transferability of post yield fracture data from small scale to large scale specimens and plant components. E.Roos (Staatliche Materialprufungsanstalt, Univ. Stuttgart, Stuttgart, Germany).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.15/1-18 In German.
The author investigates whether results from small scale tests are applicable to plant components. The mechanical features of the experimental probes are sketched, and detailed dimensions are given. The probes were made of 22NiMoCr37 and were subjected to stresses of from about 800 to 930 N/mm^2. (10 refs.) *G.R.S.*

70647 Influence of cladding on the linear elastic RPV analysis during a loss-of-coolant accident. A.Sauter (Staatliche Materialprufungsanstalt, Univ. Stuttgart, Stuttgart, Germany), R.D.Cheverton, S.K.Iskander.
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.16/1-27 In German.
This investigation concerns axial cracks in a cladded cylindrical vessel which experienced circumferential stresses. A mathematical analysis and solution is presented. (11 refs.) *G.R.S.*

Bound coherent and incoherent thermal neutron scattering cross sections of the elements ....See Entry 69799

Description of the properties of 10CrMoNiNb910 ....See Entry 70689

Nondestructive analysis of the structure of pressure vessel steels by micromagnetic testing techniques ....See Entry 70690

The influence of the flow and material characteristics on failure analysis ....See Entry 70694

Numerical simulation of post-yield fracture mechanics experiments and the possibility of application of results to plant components ....See Entry 70695

Fracture analysis of a pressure vessel with a semi-elliptical surface-crack by three-dimensional elastic-plastic finite element calculation ....See Entry 70696

An evaluation of approximate methods for calculating anisotropic flux escape and transmission probabilities for cylindrical annular regions ..See Entry 70708

Containment vessel design and practice ....See Entry 70717

Determination of fracture-mechanic properties by using the near-field of dynamically loaded cracks .... See Entry 73216

28.42 FISSION REACTOR MATERIALS

70648 Basalt glass ceramics for the immobilization of transuranic nuclear waste. L.A.Chick, R.O.Lokken (Pacific Northwest Lab., Battelle, Richland, WA, US), L.E.Thomas.
Am. Ceram. Soc. Bull. (USA), vol.62, no.4, p.505-9, 516 (April 1983).
A reference transuranic (TRU) nuclear waste was found to be similar in composition to natural basalt, a leading candidate for a deep geologic repository. Because of this similarity it is particularly desirable to develop basalt-based TRU waste forms. A basalt glass-ceramic containing 50 wt.% TRU waste was developed and characterized. Crystallization of the parent glass produces a material containing about 15 wt.% of titaniferrous hematite and 20 wt.% of two clinopyroxenes in a continuous glass matrix. Static leach testing revealed that the glass-ceramic has slower leach rates than the parent glass. The improvement in leach rate is thought to be caused by an increase in glass matrix durability due to the removal of alkaline-earth elements during crystallization. (13 refs.)

70649 Nuclear waste management in Sweden. W.Gries.
Atomwirtsch.-Atomtech. (Germany), vol.28, no.5, p.273-5 (May 1983). In German.
The present contribution to electricity generation by nuclear power in Sweden is almost 40%. For this limited nuclear program a realistic waste management program has been drafted, which is already being implemented. Nuclear waste management is restricted to handling the radioactive waste associated with nuclear power plant operation. A temporary storage facility for spent fuel elements is under construction, a special ship for fuel transports has been delivered, the construction permit for the repository designed to accommodate low and medium level wastes, which is to be ready for use in 1988, will probably be granted this year. A temporary storage facility for vitrified high level waste and a temporary storage facility for transuranium waste are to be completed by 1990. The repository for high level waste is to be operational not before 2020. (10 refs.)

70650 Oxide stripping from AGR fuel can by sputter ion plating (SIP). J.P.Coad (AERE, Harwell, England), R.K.Wild.
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.321-9 (March 1983).
A novel technique for removing oxide from iron based alloys, involving sputter ion plating (SIP) of nickel at elevated temperatures, has been recently developed at Harwell. The SIP of nickel is used to apply stress to the oxide which causes it to fracture. This method has been used to strip oxide from a 20% Cr/25% Ni/Nb stabilised steel oxidised in CO_2 at 1123 K. Both the alloy and oxide side of the metal/oxide interface is exposed and surface analytical techniques have been applied to characterise the interface. This paper describes the preliminary results of this work and gives an assessment of the possible future applications of the technique. (16 refs.)

70651 Thermal aspects of radioactive waste burial in hard rock. D.P.Hodgkinson, D.A.Lever, J.Rae (Theoretical Phys. Div., AERE, Harwell, England).
Prog. Nucl. Energy (GB), vol.11, no.2, p.183-218 (1983).
One of the possible methods that has been considered for the disposal of radioactive waste is deep burial in stable rock formations. The authors review recent work on modelling the way in which the heat emitted by the decaying radionuclides in the waste could affect this disposal option, emphasizing both the effects on depository design and on migration by flowing groundwater. It focuses particularly on research in the UK into the feasibility of burying high-level waste in fractured crystalline rock. After introductory sections on the characteristics of the waste and rock, there are three major sections on the temperature field in the surrounding rock, the stresses generated in the rock, and the groundwater flow. (154 refs.)

70652 Dynamic analysis simulator and condensate demineralizer operation of the radioactive waste treatment system for a BWR power plant. H.Mikawa, T.Ito, Y.Kato (Energy Res. Lab., Hitachi Ltd., Ibaraki, Japan).
J. At. Energy Soc. Jpn. (Japan), vol.25, no.2, p.126-32 (Feb. 1983). In Japanese.
Describes the dynamic analysis simulator, the condensate demineralizer operation, and the components of a monitoring system of the radioactive waste treatment system (R/W) for a BWR power plant. The simulation and the monitoring system have the following features: (1) The simulator can predict the few days future operating characteristics of R/W. (2) The operating conditions of the condensate demineralizer are displayed on the cathode ray tube (CRT) as guidance. By following this guidance, the condensate demineralizer can be regenerated at regular and appropriate intervals. (3) The plant conditions from the generation of liquid waste to final treatment process are displayed in the following steps: R/W total system→Particulars of each liquid waste treatment system→each component of the treatment system. (7 refs.)

70653 Treatment of radioactive wastes by calcination. P.Ditl, J.Jecmen (CVUT, Praha, Czechoslovakia), J.Napravnik, L.Neumann.
Jad. Energ. (Czechoslovakia), vol.29, no.4, p.145-8 (April 1983). In Czech.
This paper provides supplementary information about the treatment of radioactive wastes reported in pt.I (1981). Possible types of calciners are described and discussed. On the basis of experiences and calculations the new type of a calciner and pilot plant device for calcination and denitration have been developed and operated under non-radioactive conditions for about 1200 hours. Obtained calcination product was found suitable for further treatment. Also a performance test under the real radioactive conditions which was carried out on the nuclear power plant in Jaslovske Bhunice was successful. (8 refs.)

70654 Factors influencing the choice of processes for the treatment of intermediate-level wastes. J.R.Grover, N.J.Keen (UKAEA, Harwell, England).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.33-50
The wastes considered are defined by the IAEA as intermediate-level wastes—i.e. those wastes which, because of their radionuclide content, require shielding but need little or no provision for heat dissipation during their handling, transportation and disposal. Thus, transuranic wastes, fuel element cladding, miscellaneous sludges and concentrates from the treatment of liquid effluents from reprocessing plants and reactors, miscellaneous items of redundant plant, etc., are covered. There are many factors that can affect the choice of waste treatment, conditioning and packaging methods and the ultimate form of disposal. For each type of waste it is necessary to take into consideration every step in the overall system from waste arising to final disposal if an optimum solution is to be achieved in terms of economics and environmental impact. The factors that should be considered include: (1) control of wastes at point of arising (i.e. minimization and segregation); (2) level and nature of activity; (3) physical form of the wastes; (4) waste treatment process options, i.e. removal of activity, secondary effluents, quality of the final waste form, i.e. leach resistance, radiation stability, etc., volume of the final waste form, radiation dose to operators, treatment costs, interim storage costs; (5) transport requirements and costs; (6) disposal system, i.e. site selection (geological barrier to radionuclide migration), design and type of repository engineering (i.e. additional barriers), and costs. (4 refs.)

70655 Guideline for immobilization, packaging and storage of low- and intermediate-level radioactive wastes. J.Aeppli (Nuclear Safety Dept., Federal Office of Energy, Wurenlingen, Switzerland).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.51-5
Waste acceptance criteria for disposal have not yet been established in Switzerland. A guideline for immobilization, packaging and storage of low- and intermediate-level radioactive wastes from nuclear power plants in Switzerland became effective in 1980. This guideline is a basic document for the Swiss Nuclear Safety Department for licensing purposes and has the following aims: to define essential requirements; to specify quantitative limits; to provide some guarantee for acceptance of waste for disposal. The author deals with different requirements mentioned in the guideline either qualitatively or quantitatively. One of the important values is the maximum leach rate of 10^{-2} $kg.m^{-2}.d^{-1}$ measured over a period of 150 days. The test method is in conformity with the prescription laid down in a draft version by the International Organization for Standardization. Another main requirement is the stability of the submerged waste form against swelling and cracking. Wastes from reprocessing of spent fuel are not covered by this guideline. (no refs.)

70656 The function of waste immobilization as a barrier against radionuclide release in the frame of an overall risk assessment. F.Girardi (Comm. of European Communities, Joint Res. Centre, Ispra, Italy).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.57-67
The general approach to safety assurance in disposal of radioactive waste is the 'multi-barrier' or 'defence-in-depth' approach. Research has been mostly directed to characterize individual barriers in order to learn what performance may be expected from the barrier when utilized in a hypothetical safety system. The knowledge available is briefly reviewed, with special reference to ongoing activities carried out within the framework of the waste management programme of the European Communities. The interaction between different barriers in a geological disposal environment is not sufficiently well known to permit a full appreciation of the long-term behaviour of a barrier system. Examples of studies under way within the programme mentioned above are outlined briefly. On the basis of the information available, immobilization of high-level waste in borosilicate glass appears an acceptable barrier, well-integrated in the various barrier systems. Studies on the long-term properties of conditioned alpha-contaminated waste deserve a high priority in order to make a balanced evaluation of the long-term risks of the various waste types. (11 refs.)

70657 Effects of ionizing radiation during the disposal of radioactive wastes into geological formations. V.I.Spitsyn, V.D.Balukova (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.69-76
Basic propositions related to the specific features of the thermal and radiation influence of high-activity wastes on the geologic environment of repositories are considered. Boundary values of admissible dose loads on protective barriers on the basis of aluminium silicate minerals are proposed. Data on the effects of ionizing radiation on the surface properties of minerals are put forward. (7 refs.)

70658 High-level reprocessing waste package requirements for a deep borehole disposal facility to be mined in a salt dome. J.Hamstra (Netherlands Energy Res. Found., Petten, Netherlands).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.77-86
The ultimate disposal of high-level waste may entail waste package requirements that differ from or complement those originaly specified for the immobilization process. Waste package requirements are presented for a disposal concept based on the use of deep boreholes, as in a Netherlands concept for a facility to be mined in a salt dome. Most attention is given to the rather stringent rock salt temperature limitations that were formulated in anticipation of the presence within the repository area of minor bands of K and/or Mg salts. For three different canister diameters a review is given of the variations in the high-level waste and the disposal-geometry parameters as calculated to be consistent with the predetermined maximum rock salt temperatures. The canister construction and its wall thickness are discussed in relation to the stacking load and the rock pressure build-up around the emplaced canisters due to borehole convergence and a subsequent temporary excess of rock pressure due to thermal loading. Finally, it is argued that carefully developed deep borehole disposal in a salt dome involves no additional waste package requirements deriving from the generic safety assessment other than that the waste form should be solid. (4 refs.)

70659 PILO—a Swedish concept for the central treatment of spent ion-exchange resins. C.Thegerstrom (Swedish Nuclear Fuel Supply Co., Stockholm, Sweden), B.Bergstrom.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.89-100
A new method for the treatment of spent ion-exchange resins from nuclear power plants has been studied in Sweden. In a special process the radionuclides are transferred from the spent organic resins to zeolites/titanates. The zeolites/titanates are then sintered to a stable ceramic body of small volume, while the low-level eluted resins are either dewatered in transportable concrete containers or incinerated. The main functions of the new method (PILO process) have been verified in experiments. On the basis of this R&D work, industrial-scale system design studies have been made, including transport requirements, integrated process flow sheets and cost estimates. The full-scale system comprises: transport of spent organic resins from power plants to a central treatment plant; elution of medium-level resins and sorption of eluted nuclides on zeolites/titanates; sintering of active zeolites/titanates into ceramic bodies; and incineration of eluted organic resins and other low-level organic resins (optional). An evaluation of such a new system designed to cover the needs of the Swedish nuclear programme shows that it is technically feasible to introduce the PILO process on an industrial scale. It is, however, economic only if incineration of low-level resins in included in the system. (2 refs.)

70660 Experience in industrial operation of the plant for immobilizing radioactive wastes in thermosetting resins at the Ardennes Nuclear Power Station. P.Haller, P.Romestain (Centrale Nucleaire des Ardennes, Chooz, France), G.Aude, J.P.Bruant.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.101-32 In French.
The French Atomic Energy Commission has developed, at the Grenoble Centre for Nuclear Studies, a procedure for immobilizing low-and intermediate-level wastes in thermosetting resins of the polyester or epoxy types. To demonstrate feasibility on an industrial scale, a pilot plant has been set up at the effluent treatment station of the Ardennes Franco-Belgium Nuclear Power Station, which is a 305 MW(e) PWR type. Assembly work began in January 1979. After a period devoted to final adjustments and operation with inactive products, conditioning of active products began in January 1981. The methods of conditioning the three types of waste (evaporation concentrates, ion exchange resins and filter cartridges) are described, experience of the start-up and operation of the plant is reported and the principal results of coating characterization tests are given. The results of tests on active and inactive products show that the characteristics of the materials obtained on an industrial scale match those of laboratory products and confirm their high quality with regard to mechanical behaviour, fire resistance, homogeneity and low-leachability. Industrial experience and economic comparisons show that the process of immobilizing waste from nuclear power stations in thermosetting resins offers an extremely interesting alternative to classical methods of conditioning. (1 ref.)

70661 Solidification of radioactive wastes using thermoplastic resin. Y.Hayase (Niigata Engng. Co. Ltd., Tokyo, Japan), N.Moriyama, M.Hayashi, M.Kurita.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.133-45
A new method has been developed by Niigata Engineering Company, Japan, of solidifying BWR wastes, i.e. evaporator concentrates, spent ion-exchange resins (granular and powder), and filtration sludges (cellulosic materials and diatomaceous earth), using thermoplastic resin as the fixing agent. Due to the fact that in Japan a suitable method for the final disposal of nuclear wastes has not yet been decided upon, at NEC the authors proposed and developed their own process. The method was developed with the following objectives in mind: (1) reduction of waste volume; and (2) effective immobilization of radionuclides. After close examination of the existing methods of waste treatment, i.e. solidification of wastes into monolithic block form with sea dumping as the means of the final disposal, and solidification of wastes into pellet form for interim storage until disposed of, after experiments a new method of binding wastes with thermoplastic resin was developed. Using this process only one system component is needed to produce both of the above-mentioned forms of solid waste. The process was tested by solidifying some wastes containing ^{60}C and ^{137}Cs adsorbed by adding $^{60}CoCl_2$ and $^{137}CsCl$ solutions to waste slurries. The safety of the process and the behaviour of the radionuclides at each step of the process were closely checked. Subsequently the solidified products were tested and evaluated. Monolithic products were tested to determine such factors as density, uniformity, mechanical strength and leachability. Pellet form products were evaluated mainly with regard to maximization of volume reduction and mechanical strength; more than acceptable results were achieved in all cases. (8 refs.)

70662 Low- and medium-level aqueous radioactive waste immobilization with water-extendible polymers. A.S.Williamson (Res. Div., Ontario Hydro, Toronto, Ontario, Canada).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.147-54
The use of water-extendible polymers as an alternative to cement for the immobilization of aqueous radioactive wastes is detailed. The process involves formation of a water-in-oil emulsion between the aqueous waste and the organic polymer and solidification of the emulsion by addition of suitable peroxide catalyst/promoter combinations. Emulsion quality is critical to the attainment of satisfactory waste forms. High speed, high shear agitation is needed to obtain the aqueous phase droplet size and dispersion needed to give stable emulsions. The pH of the aqueous waste should be adjusted to between 7 and 9 to facilitate emulsion formation. It is also suggested that the aqueous waste: polymer ratio should not exceed 1:5:1 by volume. As incorrect waste condition, unsuitable mixing or improper cure agents can cause a process malfunction, small-scale trials with all wastes are recommended to determine special requirements before commencing production runs. Immobilized wastes should be smooth, hard monolith forms with high compressive strengths and good freeze/thaw and water resistance. If fully exposed to air the waste form will slowly lose water by evaporation. This feature may dictate the use of plastic or lined containers to prevent corrosion if any water condensation occurs in the ullage space above the waste form. Wastes immobilized with

water-extendible polymer are considered to have acceptable leaching resistance and waste type appears to have little effect on leach rate. Over a one-year test period cumulative percentage activity released was about 1%. (no refs.)

70663 Immobilization of waste-water residues by embedding into concrete. E.Zange, W.Schlenter, M.Laser (Decontamination Dept., KFA Julich GmbH, Julich, Germany).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.155-66
Low-level radioactive waste water is concentrated by evaporation. The concentrate is further evaporated to dryness by means of a rotary drum drier. The dry solid is immobilized with cement. From the drum drier solid/cement/water-mixture samples are taken. After a period of 28 days the leach rate of Cs, Sr and Co and the compressive strength of the specimens are determined. The leach rate can be described by diffusion during a starting period of about 7 to 14 days. After about 300 to 550 days, depending on the composition of the specimen and the isotope, the leach rate becomes constant. The leach rate increases with increasing dry solid/cement ratio. Other waste components (e.g. sulphate) can increase the leach rate appreciably. The influence of sulphate can be overcome by addition of $Ca(OH)_2$ and/or reduction of the dry solid/cement ratio. The compressive strength of the specimens is of the order of about 15 N/mm^2 with a minimum of about 6.4 N/mm^2 and a maximum of about 25 N/mm^2. It increases with decreasing water/cement ratio and dry solid/cement ratio. As expected, the leach rate decreases with increasing compressive strength. However, this correlation is relatively weak because of the influence of many factors on the properties of the immobilized waste form and the limited amount of data from leaching experiments. Based on these results the formula for the conditioning of drum drier solid has been optimized as regards volume reduction and quality of the waste form. (no refs.)

70664 A process for the immobilization of a radioactive waste (inorganic ion-exchange material) in a cement matrix. A.D.Elsden (British Nuclear Fuels Ltd., Risley, Warrington, England), J.Sims, K.Harding.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.167-76
A process for the immobilization of an inorganic ion exchange resin in a cement matrix is presented. The selection of the preferred matrix is described, alternative cementation processes reviewed and a flowsheet, flow diagram and plant layout of a conceptual design presented. The results of a R&D programme on the evaluation of the immobilized waste form are given. (5 refs.)

70665 Treatment of plutonium-contaminated metallic waste by the electro-slag melting method. A.Ochiai, K.Kitagawa, Y.Sawada (Kobe Steel Ltd., Kobe, Japan), S.Izuhara, K.Ohtsuka.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.177-90
Kobe Steel Ltd. and Power Reactor and Nuclear Fuel Development Corp. have developed an entirely new process for treating plutonium-contaminated metallic waste. The electro-slag melting method is a process in which contaminated metal is melted in the molten slag in a copper mould by Joule heat generated with large amounts of electrical current and then gradually solidified in the same mould. The development consisted of two experimental phases where the effect of decontamination and immobilization was studied using HfO_2 to simulate PuO_2. First, a pilot electro-slag melting furnace was built and tested, and secondly, a technical test furnace was fabricated to confirm the first phase results. This technical test furnace was approximately as large as the furnace we are now designing for the plutonium waste treatment facilities. The ratio of volume reduction was optimal and would be 1/25 if the ingot fill in the storage vessel were 0.5. The decontamination factor of the metallic waste was 25. Of the different electrodes tested, two tungsten nonconsumable electrodes were found to be the most suitable for melting pieces of metallic waste. $CaO/Al_2O_3/B_2O_3$ slag was determined to be the most suitable slag. (5 refs.)

70666 Research on the management of fuel cladding waste. B.Huber (Comm. of the European Communities, Brussels, Belgium).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.191-203
Cladding waste, arising in fuel reprocessing plants, has a considerable radioactivity content including long-lived radionuclides and should, therefore, be conditioned appropriately prior to disposal. The author gives a survey of research and development work on cladding waste characterization, decontamination and conditioning. Most of the work reported has been performed under the European Community's R&D programme on management and storage of radioactive waste, but information on other work has also been included. A wide range of conditioning methods for cladding waste has been developed to various stages, in particular: role compaction and embedding in concrete; press compaction and embedding in a lead alloy; embedding in various other matrix materials, i.e. borosilicate glass, graphite, aluminium, alumina; special melting techniques, i.e. eutectic melting and Inductoslag melting; hot isostatic pressing; and conversion of Zircaloy to zirconia. (12 refs.)

70667 Conditioning of metallic Magnox fuel element debris. C.J.Kaye (CEGB, Manchester, England).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.205-22
The conditioning of metallic Magnox debris poses particular problems arising from its chemical reactivity and from the presence in discrete amounts of highly radioactive components. The treatment of this waste is currently being studied by the Central Electricity Generating Board. Following retrieval from store it is envisaged that the debris will be dried and comminuted to facilitate the removal for further storage of the highly active components from the bulk debris. A satisfactory means of sorting the debris appears to be by magnetic induction. The relatively low activity but potentially reactive Magnox will then be directly encapsulated prior to disposal off-site. Currently the only disposal route open for this waste is to the deep ocean. Matrices for encapsulating Magnox have been developed and others are under investigation. The desirable features of such matrices include low chemical reactivity and impermeability to water. The methods used to characterize the resultant waste forms and the results obtained are presented. Thermosetting polymers produce suitable waste forms for sea disposal, exhibiting high mechanical strength and resistance to leaching, and possessing very low chemical reactivity with respect to the Magnox waste. Low viscosity matrices are advantageous from the point of view of the process plant engineering as they enable the comminuted waste to be directly encapsulated. (6 refs.)

70668 Fixation of calcined waste by bituminization or cementation. J.Napravnik, M.Kyrs (Nuclear Res. Inst., Rez, Czechoslovakia), P.Ditl.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.223-8
The overall concept is given of the combination of calcination with fixation into bitumen, cement, etc. The design is shown of a calciner with the capacity of 10 L/h which was tested on real radioactive wastes for 2000 h. The geometrical and operating parameters of the apparatus have been optimized based on a statistical evaluation of the experiments. Wastes containing nitrates are calcinated at 300-500°C, yielding oxides. Wastes containing sulphates, carbonates, $KMnO_4$, or borates are calcined at 150-300°C, yielding soluble salts. The content of H_3BO_4 and $Na_2B_4O_7$ and in some cases of sulphates in the calcinate retards hardening of the mixture with cement. Nitrates and detergents also interfere. The effect of the above components on the products mixed with bitumen is much less. Detergents can be decomposed at 200-300°C; organic acids can be reacted with Al salts to form insoluble substances lowering the leaching rate of Sr and Cs; small amounts of SiO_2 eliminate the effect of borates on cement hardening. The drawbacks of bituminization with bitumen emulsions are the complicated preparation of the emulsion, higher leaching rate of the product and low stability of the emulsion against breaking. The leachability was determined (1-50 days) of different products containing LWR wastes. (4 refs.)

70669 Conditioning of low-heat-generating radioactive waste by incorporation in barrier-impregnated composite matrices—a review of experience in industrial-scale operation. Kanwar Raj, P.K.Wattal, N.Chanana, M.K.S.Ray, M.S.Kumra (Waste Management Div., Bhabha Atomic Res. Centre, Bombay, India).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.229-44
The extent of conditioning of aqueous radioactive waste is dictated by its activity and heat content, chemical and radio-chemical constituents, total dissolved solids, repository characteristics and economics. The authors detail the above conditions with particular reference to the management of a waste stream generated from reprocessing of low burn-up research reactor fuels. Details of the evaluation of different matrices, ranging from vitreous, bituminous, cement and polymer to composites, developed for this waste stream, selection criteria, repository characteristics and process features are presented. The results of analysis of the environmental impact of storage of this conditioned waste in the near-surface repository at Tarapur are discussed. (6 refs.)

70670 CEC research activities into the immobilization of volatile radionuclides from reprocessing. W.Hebel, G.Cottone (Comm. of the European Communities, Brussels, Belgium).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.245-51
Immobilization and storage of volatile radionuclides is part of the European Community's research programme in the area of radioactive waste management and storage. Since the first multiannual R&D Programme of Indirect Action, started in 1975, numerous research projects were and are being supported by means of contracts concluded with various organizations and companies in the member states. Among the volatile radionuclides particular attention is given to krypton-85, tritium, iodine-129 and carbon-14. As to krypton-85, the methods studied concern its incorporation into a metal matrix by ion sputtering, its locking up into zeolites and its filling into pressure bottles. For the latter, temporary storage in engineered structures on land and sea disposal have been evaluated. In addition, possible liquid metal embrittlement of structural and container materials by rubidium, the decay product of krypton, has been investigated. Concerning the immobilization of tritium, methods of fixation with calcium phosphates and as metal hydrides have been studied in connection with a preceding screening study on the subject. For iodine-129, a comprehensive study has been drawn up which gives a detailed state of the relevant management technologies, taking into account the radiological aspects. Regarding finally carbon-14, an assessment study has recently been taken up evaluating the state of knowledge and pointing out possible research requirements. (13 refs.)

70671 Development of processes for incorporation of radioactive waste in glass/metal compounds and ceramic materials. L.N.Lazarev, Yu.V.Kuznetsov, E.A.Shashukov, L.I.Krylov, A.G.Tutov, V.V.Dolgov, A.S.Aloi, P.G.Dobrygin, V.N.Romanovskii, A.S.Strel'nikov, V.V.Shorin.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.253-63 In Russian.
Gives the results of studies on incorporation of radioactive waste in glass-metal compounds and also in porous inorganic materials, which are thereafter converted into vitreous or ceramic products. (6 refs.)

70672 Practice followed at the Cadarache Nuclear Research Centre in the conditioning of solid radioactive wastes for purposes of temporary storage while awaiting disposal. J.Marcaillou, J.C.Faure (Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-lez-Durance, France), A.Bernard, J.C.Nomine.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.267-82
To ensure the safety of intermediate storage of solid radioactive wastes produced by the facilities at the Cadarache Centre, a system of pre-conditioning has been developed and put into practice. This system meets the following requirements: 1) reduction of volume in order to limit the area used at the Centre and the number of transport operations subsequently needed for disposal; 2) protection of the environment; and 3) the possibility of retrieval of packages for disposal (choice of packaging). The industrial techniques used and the results obtained at Cadarache for more than ten years are described and analysed. The cement/bitumen impregnating matrix injected into the container after compacting or—in the case of non-compressible wastes—after filling has been the subject of performance trials to determine its physical and mechanical properties. A full-scale leaching test is made on an 870-litre block consisting of real compacted and impregnated process wastes, the contamination of which is due mainly to plutonium and americium and to a lesser extent to caesium and cobalt. On the basis of analyses performed on the leaching agent, after 165 days the leaching test shows the impregnation to be generally satisfactory in performance. The plutonium released is found to be insignificant, the cumulative fraction of americium is in the region of 3.3×10^{-7} while the fraction of caesium released is 8×10^{-4}. (3 refs.)

70673 Long-term corrosion behaviour of metallic drums for low- and medium-level waste forms. W.Hauser, E.Smailos, R.Koster (Inst. fur Nukleare Entsorgungstech., Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.283-92
The potential release behaviour of radionuclides from the waste into the liquid phase in an event resulting from brine intrusion into a repository is determined by, among other factors, the quality of the waste package (waste form and packaging). In order to assess the importance of packaging, long-term corrosion tests (13 years) were performed on painted 200 L metallic drums in the Asse salt mine under various storage conditions. For the investigation of corrosion the familiar metallurgical methods were used (e.g., roughness measurements of the paint surface and of the steel bottom, metallographic examinations, etc.). The most significant results of these investigations can be summarized as follows: (1) At places where the paint had not been damaged prior to storage, corrosion attack was found neither on the coating nor on the basic material. (2) At places where the paint had been damaged down to the sheet metal on account of handling and in the contact areas of hoops and packaging material where the drums had not been painted, crevice and pitting corrosion was measured. Corrosion depths of about 30% to 50% at the maximum of the metal thickness were found in these areas. Further, the investigations demonstrated that the organic coating used provides good protection against the external corrosion of brines. The results were related to the time-dependence of the specific activity in typical LLW forms. (3 refs.)

70674 Development of a waste-containing unit for use in shallow-land burial. V.V.Larsen, K.Brodersen (Riso Nat. Lab., Roskilde, Denmark).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.293-303
The purpose of this investigation is to try to improve the safety of disposal of low- and medium-level radioactive waste in man-made constructions placed below ground but near the surface. A standard waste unit of hexagonal shape has been developed. Empty containers without lids are prefabricated from reinforced concrete. The waste is placed in the container—using remote control if necessary—and a lid is cast directly on top of the waste. The hexagonal shape was selected since it is suitable for an overpack container used for standard 210 L drums and since units can be placed together with very little space between them. This space is supposed to be filled with bitumen or concrete after placing the unit in the repository. One option under investigation in the study is to make the units of a new type of concrete called Densit, which has a much higher compression strength than ordinary concrete. The diffusivity for dissolved ions in the material is low, and the electrical resistivity is high. The material will therefore act as an additional barrier against migration of radioisotopes from the waste. More important, from a safety point of view, is that the disposal system as a whole is supposed to prevent contact between waste and water for a very long time. Preliminary results from laboratory investigations of the properties of the new material are reported. (2 refs.)

70675 Conditioning of low-level solid radioactive wastes for sea disposal at ECN, Petten. C.Koning (Netherlands Energy Res. Found., Petten, Netherlands).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.305-14
The radioactive wastes are collected from hospitals, universities, power stations and research centres in 100-litre steel drums. The drums are transported by a normal road-truck to the waste treatment facility at Petten. The steel drums with unsorted wastes are compacted by a high-pressure compaction facility with a total force of 1500 tonnes. The facility, including the storage of the 100-litre and 200-litre drums and the concrete mixer, is operated automatically by a minicomputer. In a 200-litre drum a layer of 10 cm concrete is poured on the bottom. In this layer reinforcement bars are fixed. The packets from a selection table are placed into the 200-litre drum to a maximum height of 64 cm. The packets are secured and centred by the bars. Concrete, with a compressive strength of about 40 N/mm^2 after twenty-eight days, is poured around the packets and on top of them. The concrete walls are 3.5 cm and the top is at least 10 cm thick. The data of the waste drums are collected by the minicomputer and on request one obtains the so-called dumping list with, for example, drum number, weight, radiation and activity per radionuclide. (3 refs.)

70676 Experience with the cementation of fluid waste. C.J.Lobbezoo (GKN Dodewaard, Dodewaard, Netherlands), F.Geevers, C.D.Andriesse.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.315-19
A discussion is given of practical problems with the cementation of fluid waste from a nuclear power plant. The fluids are slurries of precoat and resins, which are mixed with salt evaporator concentrate before adding cement. This mixing should result in homogeneous waste batches with a specific composition and gamma activity. The authors describe how this mixing is achieved within the specified parameters. After cementation the product is believed to be chemically stable and it is directly transportable as low-level waste. (1 ref.)

70677 Characterization of conditioned low- and intermediate-level wastes. D.Alexandre (Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-lez-Durance, France), A.Billon, J.Bourdrez, J.C.Nomine, C.de Tassigny, P.Pottier.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.323-45
All radioactive wastes must be conditioned to satisfy the criteria for disposal of them in the ground. In accordance with the specifications laid down by the Agence nationale pour la gestion des dechets radioactifs (French National Agency for Radioactive Waste Management—ANDRA), waste characterization records must be drawn up, with the relevant tests being carried out under approved conditions. The authors summarize the principal results acquired in laboratories of the French Atomic Energy Commission (CEA) under the characterization programme, which was initiated by ANDRA and to which the Commission of European Communities (CEC) has contributed within the framework of its five-year indirect-action programme (1980-84). The principal aspects of these characterization tests are concerned with leaching from normal-sized packages, techniques measuring the radioisotope diffusion rate in thermosetting resins, study of the chemical forms of the radioisotopes released and assessment of the resistance of the coatings to the action of micro-organisms in the soil. (8 refs.)

70678 An assessment of the role of testing and prediction of waste form performance for storage and disposal. P.Pottier (CEA, Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-lez-Durance, France), P.D.Johnston, E.Maestas.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.347-56
The objective of waste form evaluation is to ensure that reliable data are available to describe nuclear waste materials in safety, quality, acceptability and environmental analyses for transport, storage and disposal requirements. Although many test methods are routinely used for different purposes in the nuclear fuel cycle, there is a need for test methods to yield comparable data so that waste products can be uniformly classified or characterized. In the absence of international, or in some cases national, agreement on the methodology for particular tests it is often difficult if not impossible to compare the results obtained by different groups of workers even for similar waste/binder combinations. Recognizing this problem, the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development convened a group of technical experts from its member countries to examine the present status of the methodologies and rationale for radioactive waste form evaluation and testing. The authors describe the results of this workshop. (no refs.)

70679 Investigation of activity release from bituminized intermediate-level waste forms under thermal stresses. W.Kluger, P.Vejmelka, R.Koster (Inst. fur Nukleare Entsorgungstech., Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.357-66
To detemine the consequences of a fire during fabrication, intermediate storage and transport of bituminized $NaNO_3$ waste forms, the fractions of plutonium released from the waste forms were assessed. For this purpose, laboratory tests were made with PuO_2-containing specimens as well as a field test with specimens containing Eu_2O_3. By the evaluation of plutonium release in the laboratory and by the determination of the total sodium release and the relative Eu/Na release in the field tests the plutonium release can be deduced from full-scale specimens. (4 refs.)

70680 A study of certain properties of bitumen compounds which determine the conditions for their storage. M.I.Zhikharev, K.P.Zakharova, A.S.Polyakov, I.A.Sobolov.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.367-73 In Russian.
The extent to which solidified radioactive waste is securely isolated in a repository is determined by the hydrogeological conditions at the site, the impermeability to water of the engineered barriers and the properties of the waste being stored. The main causes of radionuclide migration may include inadequate impermeability, explosion, fire or changes in the properties of the materials during storage. Radiation or microbiological processes may give rise to changes in the properties of the compounds. The authors give the results of a study of the biological stability of bitumen compounds, the risk of explosion of bitumen compounds in storage, the fire hazard associated with the production and storage of bitumen compounds, and the possibility of extinguishing fires. (no refs.)

70681 The development and evaluation of SYNROC for high-level radioactive waste immobilization. K.D.Reeve, D.M.Levins, E.J.Ramm, J.L.Woolfrey (Australian Atomic Energy Comm. Res. Establ., Sutherland, NSW, Australia).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.375-90
The current status of SYNROC evaluation and development by the Australian Atomic Energy Commission is reviewed. The methods used for the evaluation of leach, irradiation, thermal and mechanical stability of SYNROC are described. A range of tests shown that SYNROC is more leach resistant than borosilicate glasses over the temperature range 45-300°C. Because of its excellent stability under hydrothermal leach conditions at 300°C, SYNROC could be used to immobilize and dispose of high-level waste without long periods of engineered storage likely to be necessary for borosilicate waste glass. Accelerated radiation damage testing using fast neutrons has simulated storage times of up to 9×10^5 years. The results indicate that actinide decay damage is unlikely to cause deleterious effects in SYNROC for at least 2×10^5 years and, even after much longer times, no great increase in leach rate is expected. SYNROC has been fabricated on a 30 kg scale using 'in-can hot-pressing'. Candidate processes are being evaluated for inclusion in a proposed engineered pilot plant for SYNROC fabrication. (18 refs.)

70682 Quality control of radioactive wastes. E.Warnecke, P.Brennecke (Phys.-Tech. Bundesanstalt, Brunswick, Germany), G.G.Eigenwillig, F.Heil.
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.391-404
The Physikalisch-Technische Bundesanstalt (PTB) is responsible for the disposal of radioactive waste in the Federal Republic of Germany and must prove that the waste packages comply with the disposal requirements. A quality assurance programme for radioactive waste is therefore being carried out. The quality assurance of radioactive waste can in principle be carried out by an adequate programme within the conditioning process (system-oriented control programme) or by a control of the waste packages with non-destructive or destructive test methods (product-orientated control programme). The main features of a system-orientated control programme for waste packages are described as well as the status of the development of product-orientated controls. In a first theoretical analysis, graduated control requirements for waste packages are evaluated according to their radiological importance. The development of an organization and documentation system completes the quality assurance programme. (9 refs.)

70683 Treatment, storage and disposal of low- and intermediate-level reactor wastes at Olkiluoto Power Plant. H.Harkonen, P.Lehtinen, A.Ruuskanen (TVO Power Co., Espoo, Finland).
Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.407-18
Low- and intermediate-level waste is continuously produced during operation of a nuclear power plant. Reactor waste management can generally be divided into three main stages: conditioning, storage and disposal. At Olkiluoto Power Plant intermediate-level liquid waste is solidified by incorporation into a bitumen. Compressible dry waste is compacted into 200 L steel drums. At present, all reactor waste produced is stored in the waste buildings of the plant units. A separate storage building for low-level waste is under construction and design of a storage facility for bituminized waste has been started. A great number of geological and hydrogeological investigations have been

performed to assess the suitability of the bedrock at the power plant site for the disposal of low- and intermediate-level waste. As a part of this assessment, a preliminary design of an undergound repository has been performed. Safety assessments indicate clearly that all low- and intermediate-level waste from the operation and decommissioning of Olkiluoto Power Plant can be stored and disposed of in a safe way. Consequently, current conditioning practices are considered fully adequate for storage and disposal. (no refs.)

70684 The role of waste conditioning as regards the safety of low-and intermediate-level waste disposal. E.Peltonen, S.Vuori, M.Katka (Nuclear Engng. Lab., Tech. Res. Centre of Finland, Helsinki, Finland).

Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.419-35

The authors clarify the role of conditioning of low- and intermediate-level wastes from the operation and decommissioning of LWR plants as regards the safety of the final disposal. The assessment of the conditioning requirements is based on the results of the recent studies comprising the safety analysis of a site-specific disposal system. The repository is expected to be situated on a coast in hard Precambrian bedrock below the groundwater table. Owing to the geological characteristics of the disposal site the discharge of the radionuclides to biosphere can occur only through the groundwater. The conditioning requirements are very dependent on the disposal system and the criteria employed. (7 refs.)

70685 Drafting of French regulations on the conditioning and intermediate storage of radioactive wastes from irradiated-fuel reprocessing plants. F.Habib (Ministere de la Recherche et de l'Industrie, Fontenay-aux-Roses, France).

Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.437-44 In French.

Specifications for the wastes to be produced by future plants reprocessing fuel irradiated in pressurized-water reactors—plants which will constitute extensions to the La Hague establishment—must be approved by the French safety authorities. With a view to defining the conditions of this approval, the latter have drafted regulatory documents known as 'fundamental safety requirements' for the production, monitoring, conditioning and intermediate storage of solid wastes from the reprocessing of these fuels. These regulations take the form of a general requirement applicable to all types of waste and specific requirements which depend on the type of waste and the method of conditioning. Particular attention is given in this paper to the general requirement and to the requirement for high-level wastes solidified in the form of glass. (no refs.)

70686 Considerations for waste conditioning associated with near-field phenomena and geochemical processes in a geological disposal environment. P.D.Johnston (OECD Nuclear Energy Agency, Paris, France).

Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.445-59

During 1981 and 1982, the NEA Co-ordinating Group on Geological Disposal sponsored two workshops: one on near-field phenomena in geologic repositories for radioactive waste, held in Seattle, USA, in September 1981; and the second on geochemistry and radioactive waste disposal, held at the QECD in Paris in May 1982. Material presented and discussed at these meetings has been reviewed and assessed to identify to what extent the phenomena of importance necessitate particular consideration in waste conditioning. The emphasis is on high-level wastes, although similar considerations may be relevant for other radioactive wastes disposed of in a geological environment. (4 refs.)

70687 An alternative strategy for commercial high-level radioactive waste management. C.J.Northrup (Sandia Nat. Labs., Albuquerque, NM, USA), L.J.Jardine, M.J.Steindler.

Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium, Utrecht, Netherlands, 21-25 June 1982 (Vienna, Austria: IAEA 1983), p.461-75

Discusses an assessment of benefits that could be realized from separating ^{90}Sr and ^{137}Cs from HLW and handling them separately from the bulk of the remaining solidified HLW. It is noted that treatment of the caesium and strontium separately may result in economic advantages in the waste management system and substantially improves the reliability of the performance of the waste package. (21 refs.)

70688 Materials available and the present state of research into the basis for the design of high temperature components for HTR-plants. H.Nickel, F.Schubert, H.-J.Penkalla, H.H.Over (Inst. fur Reaktorwerkstoffe, Kernforschungsanlage Julich GmbH, Germany).

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.1/1-26 In German.

Current research has reached the stage when firm statements regarding qualities of Inconel 617 and Hastelloy X with respect to their use in HTR plant can confidently be made. The chemical composition of the above mentioned metals and that of Incoloy 800H and the basic operating data of the He/He-heat exchangers are listed. The operating conditions and construction features are discussed. Analysis of the test results were used to check on ASME-Code Case N47. The effect of contaminated HTR-Helium on the properties of the structural material at 900 deg.C and over is discussed. Fatigue, creep, ratchet-creep are described and graphically presented. (16 refs.) *G.R.S.*

70689 Description of the properties of 10CrMoNiNb910. M.Dette, H.Hahn (RWTUV, Essen, Germany), H.C.D.Nieuwland, J.W.Tichler.

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.3/1-30 In German.

This material has been used in the construction of the steam generator of the sodium fast breeder reactor plant SNR-300. All sodium carrying parts of the plant are made of austenitic X6CrNi18 11, but because of the high conductivity the steam generating plant components were made of ferritic 10CrMoNiNb910. Drawings of straight pipe heat generator curves showing carburization properties of austenitic steels in contact with various ferritic steels at 600 deg.C and decarburization of ferritic steels 10 CrMoNiNb.910 in the system ferrite-Na-austenite and microphotographs of the initial and final stages of crystallization are given. Solubility of NbC in iron, hardness vs. temperature, resistance to heat, tension and compression vs. temperature are graphically described. (36 refs.) *G.R.S.*

70690 Nondestructive analysis of the structure of pressure vessel steels by micromagnetic testing techniques. W.A.Theiner, B.Reimringer (Inst. fur Zerstorungsfreie Prufverfahren, Univ. Saarbrucken, Saarbrucken, Germany), P.Deimel, D.Kuppler.

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.6/1-25 In German.

The methods used in the nondestructive tests described are based on acoustics and magnetism. The materials tested were 22NiMoCr37, X20CrMoV121, X20Cr13 at 610 deg.C. The characteristics of the microstructure of the types of crystals formed, such as 100% martensite, 70% martensite 30% bainite, 100% bainite are given. Stretch limits vs. annealing time at 610 deg.C for 22 NiMoCr37 and hysteresis curves are shown. (10 refs.) *G.R.S.*

70691 Recording length-criteria used for ultrasonic testing. E.Fischer, M.Kroning, H.Schober, H.Fischdick (Kraftwerk Union AG, Erlangen, Germany).

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.8/1-14 In German.

Ultrasonic tests for integrity of structural materials though generally applicable, falls short in some cases of complete reliability, hence the requirement for a more universal signal. The concept of length-criteria based on ultrasonic tests has been suggested. The experimental facility and the tests carried out are described. For structural difficulties it has been recommended that holography should be used to complement ultrasonic test methods. (8 refs.) *G.R.S.*

70692 Improvement of ultrasound testing by the installation of electronically controlled test equipment (phased arrays). W.Gebhardt (Fraunhofer-Inst. Furzerstorungsfreie Prufverfahren, Saarbrucken, Germany).

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.9/1-17 In German.

Phase-array aerials have been in use for a number of years in radar techniques. The principle consists of using a number of rays that can be individually electronically controlled, thus affording a flexible sonic formation and enabling longitudinal, transverse and surface surveys to be made. The three types of array: ring, linear and matrix are described and a block diagram of the array system is given. (6 refs.) *G.R.S.*

70693 Acoustic emission measurements on large specimens in the research program into component safety (FKS). J.Eisenblatter (Battelle-Inst. e.v., Frankfurt am Main, Germany), P.Runow.

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.10/1-20 In German.

Sound emission methods have been successfully used in nuclear reactors to detect structural failures, but so far they have been unable to discriminate between large and small cracks and were not reliable in cases of incipient failures. The work described aimed at improving the method and to that end tests have been carried out on large steel specimens with a variety of defects such as plastic deformation, microcracks, crack growth, friction etc. (no refs.) *G.R.S.*

70694 The influence of the flow and material characteristics on failure analysis. W.Dahl, W.Hesse, A.Krabiell, H.-J.Rosezin (Inst. fur Eisenhuttenkunde; RWTH, Aachen, Germany).

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.12/1-21 In German.

It has been found that to secure a reliable assessment of mechanical strength and long time service of nuclear plant components it is desirable to subject them to breaking stress and plastic deformation tests. The theoretical basis of the plastic deformation limits are discussed and mathematically described. The plastic flow limits can be determined quantitatively from the temperature and deformation rates, but a reliable estimate can only be obtained for low temperatures. (16 refs.) *G.R.S.*

70695 Numerical simulation of post-yield fracture mechanics experiments and the possibility of application of results to plant components. W.Schmitt, B.Voss (Fraunhofer-Inst. fur Werkstoffmech., Freiburg, Germany).

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.13/1-20 In German.

By the use of the partial load reduction method it was possible to produce high accuracy crack resistance curves at reactor temperature operating range. The experimental method of determination of the J-crack resistance curve and the crack growth is described. The deformation, expansion and stresses caused by the crack are discussed and a numerical analysis of the geometry is made. The steels used in the experiments were C25 A542 at 25 deg.C and C50 20MnMoNi55 (A533) at 285 deg.C. (19 refs.) *G.R.S.*

70696 Fracture analysis of a pressure vessel with a semi-elliptical surface-crack by three-dimensional elastic-plastic finite element calculation. D.Aurich, W.Brocks, D.Noack, H.Veith (Bundesanstalt fur Materialprufung, Berlin, Germany).

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.14/1-34 In German.

Elastic analysis taking into account 'small scale yielding' corrections for even stresses can be used for estimation of load limits. This concept has been applied to the investigation in the case of a cylindrical pressure vessel having two deep semi-elliptical cracks ($a/t=0.59$). The three dimensional elastic-plastic stress distortion analysis using the method of finite elements produced results showing stress distribution, plastic zones and crack starting profiles resulting from inner pressure. The results are discussed and it has been shown that for an ASME-code assumed K_{Ic}-value of $6900 N/mm^{-3}$ at an operating temperature of 314K the critical pressure is 280 bar. (22 refs.) *G.R.S.*

70697 Time-dependence of fracture mechanics properties. H.D.Schulze, H.Fuhlrott, G.Togler (Rheinisch-Westfalischer Tech., Uberwachungsverein e.v., Essen, Germany).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.19/1-14 In German.
Three steels 22NiMoCr37, 15MnNi63 and St 52-3 were used in tests to determine the effect of the rate of loading and charge duration at constant load on the toughness of the specimens. (9 refs.) *G.R.S.*

70698 The study of the interaction of the components of imitator-glasses of glassified radioactive wastes with various surrounding rocks. V.I.Spitsyn, A.A.Minaev, L.I.Barsova, P.Ya.Glazunov (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.9-14
This is one of the first attempts to work out a proper technique for the determination of the diffusion of the phosphate glass components into various rocks by using X-ray microanalysis. Under study was thermal and radiation-enhanced diffusion of phosphorus, chromium from phosphate glasses into the samples of basalt, metagabbro, metadunite and quartz at high temperatures (to 600°) during gamma irradiation, and radiation enhanced diffusion of ions into rocks. (5 refs.)

70699 Evaluation of ceramic materials to immobilize ICPP calcines. B.A.Staples, H.S.Cole, J.C.Mittl (Exxon Nuclear Idaho Co. Inc., Idaho Falls, ID, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.37-48
Various ceramic materials as well as Formula 127 glass have been developed to immobilize Idaho Chemical Processing Plant (ICPP) zirconia calcine. Tailored, titanate and matrix encapsulated ceramics were prepared by cold pressing and sintering reactants, while glass-ceramics were prepared by melting in a manner similar to that of preparing the glass. X-ray diffraction techniques were used to determine the presence of radionuclide and calcine matrix element host phases in each ceramic material. The aqueous leachability, practical loading capacity and the incorporation of waste elements into host phases was investigated and compared to those of Formula 127 glass through application of the Soxhlet and MCC-1 static leach tests. Potential process requirements for each material were evaluated based on the number of steps needed for laboratory-scale preparation. (9 refs.)

70700 Development of sphene-based glass ceramics tailored for Canadian waste disposal conditions. P.J.Hayward, E.V.Cecchetto (Whiteshell Nuclear Res. Establ., AECL, Pinawa, Manitoba, Canada).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.91-8
Glass ceramics and ceramics based on minerals of proven thermodynamic stability in Canadian Shield groundwaters are being developed to host the wastes arising from future CANDU fuel recycling. Sphene-based glass ceramics, produced by melting Na_2O-CaO-Al_2O_3-TiO_2-SiO_2 compositions at 1400°C, cooling, and then reheating the phase-separated glasses to approximately 1000°C, show strong partitioning of waste ions into the sphene ($CaTiSiO_5$) lattice. Leaching results suggest that these materials are durable in deionized water. In simulated groundwaters, the sphene phase appears to suffer no net leaching. Leach testing and manufacturing methods are discussed. (12 refs.)

70701 The leaching behaviour of the Swedish KBS-glasses ABS 39 and ABS 41. H.-P.Hermansson (Studsvik Energiteknik AB, Nykoping, Sweden), H.Christensen, L.Werme, K.Ollila, R.Lundqwist.
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.107-14
The planned Swedish KBS glass corrosion investigation program comprises experiments with inactive glasses containing simulated waste, prolonged in-situ tests, the characterization of corrosion products, immiscibility studies, and corrosion experiments with 'hot glass'. The authors give a short description of the entire program. They focus thereafter on some recent leaching results with the inactive KBS glass qualities ABS 39 and ABS 41, which were leached in a manner similar to the PNL MCC-1 test procedure. (3 refs.)

70702 Respirable fines produced by impacts of simulated alternative high-level waste materials. L.J.Jardine, G.T.Reedy, W.J.Mecham (Argonne Nat. Lab., Argonne, IL, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.115-23
Standardized comparative drop weight impact tests were conducted on solid alternative waste forms under consideration for immobilizing Savannah River Laboratory defense wastes. The fragment size distributions were measured in the size ranges of ~5 to 8000 μm. All waste form fragment size distributions could be described accurately by lognormal plots. Respirable sizes (≤ 10 μm) were measured. Borosilicate glass and SYNROC specimens yielded the same mass fractions of respirable sizes; FUETAP concrete, high silica and alkoxide glass specimens yielded ~2-3 times more mass fractions of particles of respirable sizes, whereas tailored (Spinel) ceramic specimens yielded the smallest mass fractions of respirable sizes, ~2-1/2 times less. (3 refs.)

70703 A methodology for characterizing brittle fracture of solid waste forms in accidental impacts. W.J.Mecham, L.J.Jardine, M.J.Steindler (Argonne Nat. Lab., Argonne, IL, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.125-31
A general method for characterizing the major practical effects of accidental impacts on waste packages and for evaluation of scale-model tests has been partially developed. Impact fracture of brittle waste forms has been shown elsewhere to produce particulates whose size distributions are described by the lognormal probability distribution. The model proposed for fragment generation involves the transformation of impact (kinetic) energy into elastic strain energy which is followed by fracture and energy dissipation into heat by the fracture particulates. The peak stresses developing during compressions are approximated as a function of time using elastic theory for a wide range of practical impact conditions for typical (glass) waste forms. The proposed methodology requires experimental validation in terms of correlation of stress and energy parameters with particulate parameters describing the results of fracture. Two kinds of preliminary correlations are presented: (1) calculations of stress parameters for a range of impact conditions of stress parameters for a range of impact conditions; and (2) averages of particulate parameters obtained in standard impact tests. (12 refs.)

70704 Alkoxide derived amorphous solids as an alternate nuclear waste form. J.M.Pope, D.E.Harrison (Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.133-9
Nitric acid waste can be immobilized in an amorphous aluminosilicate matrix that is produced by polymerization of metal alkoxides. Unlike vitreous aluminosilicate host matrices obtained by melting, neither alkalis, alkaline earths, nor borates are required since no melting is involved. Instead, the alkoxide glass formers and radionuclides react directly to form a randomly cross-linked structure of silica and alumina polyhedra. Structurally, the amorphous product formed through chemical polymerization is similar to a true glass except that it has not experienced melting. As a result, neither a glass transition temperature nor a specific volume temperature dependence would be expected in such an amorphous material. As a chemically durable waste form, the 'gel-glass' product should be substantially better than ordinary waste glass because it can be made without the addition of either alkalis or boron. (4 refs.)

70705 Solubility effects in waste glass/demineralized water systems. H.T.Fullam (Pacific Northwest Lab., Richland, WA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.173-80
A study was carried out to determine the solubility limits of various elements found in waste glasses in demineralized water as a function of temperature. The work was sponsored by the Office of Nuclear Waste Isolation under contract to the Department of Energy. Solubility measurements were carried out at 35°, 65°, 95°, and 150°C using three nonradioactive waste glass compositions. Subsaturation and supersaturation methods were used to determine the solubility limits. The two methods gave markedly different values for most glass components. The results obtained indicate that it is difficult to assign solubility limits to most glass components without thoroughly describing the glass-water system. This includes not only defining the glass type, and system temperature, but also the glass surface area-to-water volume (S/V) ratio of the system and its thermal history. (1 ref.)

Conditioning of Radioactive Wastes for Storage and Disposal. Proceedings of an International Symposium .... See Entry 69786

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management .... See Entry 69789

Application of the ASME-code-case N 47 to a typical thick-walled HTR-component made of Incoloy 800 .... See Entry 70645

Transferability of post yield fracture data from small scale to large scale specimens and plant components .... See Entry 70646

Influence of cladding on the linear elastic RPV analysis during a loss-of-coolant accident .... See Entry 70647

ZED-2 experiments on the effect of a Co absorber rod on an NRU loop .... See Entry 70713

Evaluation of fuel performance in reactor (PWR). V. Special behavior caused by cladding defect .... See Entry 70719

Transient fission product release during dryout in operating UO_2 fuel .... See Entry 70720

Ion-beam damage in hollandite .... See Entry 72019

Interpretation of laser pulse heating experiments for determination of vapour pressures of nuclear fuel materials at high temperatures .... See Entry 72092

Influence of material properties on the retention of fission products by silicon carbide coatings .... See Entry 72165

An equation for thermal conductivity of heavy water .... See Entry 72173

Effect of oxidizing environment on the strength of H451, PGX and IG-11 graphites .... See Entry 73167

Hydrides and delayed hydrogen cracking in zirconium and its alloys .... See Entry 73176

Determination of fracture-mechanic properties by using the near-field of dynamically loaded cracks .... See Entry 73216

Investigation into the yield behaviour in the area close to the crack tip of a fine-grained structure steel .... See Entry 73217

Predictive calculations of volatilities of metals and oxides in steam-containing environments .... See Entry 73267

Parameters of strain-induced corrosion cracking in low alloy steels in a flow of high temperature water .... See Entry 73286

Micro-hardness of non-irradiated uranium dioxide .... See Entry 73292

In situ neutron activation analysis of and the neutron capture cross-section for $^{90}Sr^+$ .... See Entry 73385

Nuclear waste repository characterization: a spatial estimation/identification approach .... See Entry 73501

28.42H Fuel preparation and reprocessing

(inc. isotope separation and enrichment)

70706 Fuel streams in closed-cycle light water reactors. J.Clauss.
Atomwirtsch.-Atomtech. (Germany), vol.28, no.5, p.259-62 (May 1983). In German.
The article deals with the streams of materials occurring in a closed fuel cycle on the basis of the parameters associated with light water reactors and certain recycling strategies. (2 refs.)

70707 Progress report on the uranium-enrichment process via chemical exchange. C.Bernaud, J.-H.Coates, M.Gelee, J.-M.Lerat, P.Plurien (Div. d'Etudes de Separation Isotopique, CEA, Paris, France).
Rev. Gen. Nucl. (France), no.1, p.49-52 (Jan.-Feb. 1983). In French.
Five years ago, during the Salzburg Conference set up by AIEA, the French Atomic Energy Commission disclosed the existence of a new uranium isotopic enrichment process via chemical exchange. This process provided a high enrichment coefficient, its power consumption was low and its use entailed

only conventional chemical industry processes. Other details were disclosed later on: the exchange takes place through two liquid phases, one aqueous, the other organic, brought to interact in large-size pulsed columns. These columns are arranged in series so as to obtain enrichment cascades, connected to one another according to an original layout enabling the design of modular industrial assemblies adaptable according to market requirements. The progress achieved since the Salzburg announcement is remarkable. For instance, the separation power delivered yearly per cubic metre has trebled. Thus, the absolute value of the cost per Separation Work Unit has been markedly lowered and the cost-effectiveness of the process is now broadly confirmed, particularly in the case of small-size plants. The authors present the characteristics of this process which, while remaining unsuited to proliferation, is one of the most interesting among all those developed so far. (16 refs.)

28.43 FISSION REACTOR OPERATION

70708 An evaluation of approximate methods for calculating anisotropic flux escape and transmission probabilities for cylindrical annular regions. P.D.Krishnani (Theoretical Reactor Phys. Section, Bhabha Atomic Res. Centre, Bombay, India).
Ann. Nucl. Energy (GB), vol.10, no.6, p.285-97 (1983).
In the interface current method for solving the integral transport equation, most of the computer time is spent in the precalculation of various region transmission, escape and collision probabilities. Therefore, any reduction in computer time used to calculate these probabilities will directly affect the efficiency of this method. The normal methods such as the Trapezoidal rule or Gauss-quadrature formula for calculating the various probabilities require the evaluation of many Bickley functions per integral, which is time consuming. The author discusses efficient methods for calculating the various probabilities corresponding to anisotropic terms of the angular flux expansion at region interfaces for cylindrical annular geometry. The author first discusses the application of Bonalumi's Pseudo-Linear approximation and the second-order correction to it which requires the evaluation of one and two Bickley functions, respectively, per integral. The author then discusses a Guass quadrature formula with exponential weighting and its modified form. (8 refs.)

70709 Modification of the PWR control system using a gaseous absorber. Y.Ronen, A.Galperin (Dept. of Nuclear Engng., Ben-Gurion Univ. of the Negev, Beer Sheva, Israel).
Ann. Nucl. Energy (GB), vol.10, no.6, p.331-3 (1983).
A modification of the PWR control system is suggested, based on the introduction of a gaseous absorber to the core thimbles. The absorber under consideration is ^{3}He. The advantage of the suggested method is the possibility of controlling the reactor during burnup without affecting the moderator reactivity coefficient, and without distorting the reactor axial power distribution. The suggested method also provides a redundancy of the control system. Initial calculations corresponding to this modified control system are presented, while its advantages and disadvantages are discussed. (1 ref.)

70710 Supervisory control of Belgium's nuclear power.
Comput. Syst. (GB), vol.3, no.5, p.15-28 (May 1983).
Explains how dual Gould SEL computers are providing supervisory control at the Belgian nuclear power complex at Doel on the banks of the Scheldt near Antwerp. (no refs.)

70711 Test facility for auxiliary cooling system (ACS) of fast breeder reactor for Power Reactor & Nuclear Fuel Development Corporation (PNC).
Ishikawajima-Harima Eng. Rev. (Japan), vol.23, no.1, p.44-50 (Jan. 1983). In Japanese.
The auxiliary cooling system is an important engineered safety feature, and is used for safe removal of heat from the reactor at the shutdown. The ACS serves as a means of testing and assessing the auxiliary cooling system for the 'Monju' and is designed and manufactured to have one fifth capacity of the Monju. The air heat exchanger and the ACS system was designed to withstand the higher temperature range of the conventional design code (MITI-501), and finned tubes were applied for effective heat removal. A preheating system was designed to heat up the whole system over 200°C within 20 hours to prevent sodium from freezing. Basic performance of ACS was verified satisfactorily by a series of performance tests, such as start up test, flow rate measurement and preheating test before delivery. The experience from designing and construction of ACS and data obtained by these tests will be very instructive for designing and construction of the 'Monju' prototype FBR. (3 refs.)

70712 Equation of equilibrium emission and retardation parameters in nuclear-power-plant turbines with dissociating nitrogen tetroxide. E.A.Orudzhaliev (M. Azizbekov Azerbaidzhan Inst. of Petroleum & Chem., Baku, Azerbaidzhan SSR).
J. Eng. Phys. (USA), vol.43, no.2, p.846-52 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.201-9 (Aug. 1982). [received: April 1983]
The equation of emission, retardation parameters, and expressions for quantities at the flow crisis are obtained for the case of dissociating nitrogen tetroxide. (3 refs.)

70713 ZED-2 experiments on the effect of a Co absorber rod on an NRU loop. G.M.Arbique, P.M.French.
Report AECL-7515, Atomic Energy Canada Ltd., Chalk River, Ont. (Feb. 1983), vi+44 pp.
A series of experiments has been performed in ZED-2 to measure the perturbing effects of an NRU cobalt absorber rod on a simulated NRU loop site containing graded enrichment UO_2 fuel. The objective of the measurements was to provide data useful in validating NRU reactor physics codes. Using a simulated NRU lattice containing a simulated NRU loop site and an asymmetrically placed Co absorber rod, measurements were made of: (a) reactivity effects, as measured by critical height changes, associated with voiding the loop and stepped insertion of the Co absorber rod; (b) flux perturbations at the simulated loop site and throughout the lattice induced by the Co rod; (c) Westcott $r\sqrt{T/T_0}$ values throughout the lattice. (5 refs.)

70714 A new fast neutron scattering technique for local void fraction measurement in two-phase flow. E.Hussein, S.Banerjee, D.A.Meneley (Dept. of Engng. Phys., McMaster Univ., Hamilton, Ontario, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1431-42 vol.2
A new non-intrusive fast neutron scattering technique for local void fraction distribution in two-phase flow is presented. The theory upon which the technique is based is discussed, illustrating the capabilities and limitations of the technique. Single scattering of neutrons is formulated into a set of non-linear equations relating the local void fraction distribution to measured neutron fluences at different energies and angles of scattering. The inverse problem of solving these equations to reconstruct phase distribution is explained and demonstrated with examples. The techniques for measuring the fluence and energy of the scattered neutrons are outlined, and experimental measurements are shown. Simulations of the measurements are compared with actual data. (18 refs.)

Materials available and the present state of research into the basis for the design of high temperature components for HTR-plants ....See Entry 70688

Evaluation of fuel performance in reactor (PWR). V. Special behavior caused by cladding defect ....See Entry 70719

Updating of the plant protection system on the Prototype Fast Reactor Dounreay ....See Entry 70721

28.44 FISSION REACTOR PROTECTION SYSTEMS, SAFETY AND ACCIDENTS

70715 Monte Carlo simulation of the emergency shutdown system for the high-temperature pebble-bed nuclear reactor. L.Bieniasz, J.Moscinski, P.Nizegorodcew, Z.Rycerz (Inst. of Computer Sci. AGH, Cracow, Poland).
Ann. Nucl. Energy (GB), vol.10, no.6, p.299-303 (1983).
A theoretical model of the emergency shutdown system for the high-temperature pebble-bed nuclear reactor is presented. The stochastic trajectory of an absorbent ball has been described as a fall with 'absorption' along the vertical axis and with planar diffusion in the horizontal directions. Small samples of the random packing of hard spheres and the absorbent balls' trajectories in them have been simulated by the direct Monte Carlo method. The values of model parameters have been estimated from the simulated distributions of the absorbent balls' displacement vectors. The estimated values agree qualitatively with experimental data. (7 refs.)

70716 PWR nozzle 'crotch corner' inspection: an effective additional ultrasonic technique for radial cracks. J.M.Coffey, J.M.Wrigley (NDT Applications Centre, CEGB, Manchester, England).
Br. J. Non-Destr. Test. (GB), vol.25, no.3, p.130-1 (May 1983).
A description is given of an ultrasonic inspection technique for the detection of cracks in PWR inlet nozzle crotch corners. The beam reflection geometry is illustrated. Experimental verification of the technique is obtained using a test block. The application of the technique to automated inspection of PWR nozzles is outlined. (4 refs.)

70717 Containment vessel design and practice. Y.Bangash (Div. of Structures, School of Civil Engng., Thames Polytech., London, England).
Prog. Nucl. Energy (GB), vol.11, no.2, p.107-81 (1983).
Attempts to review the state of the art of methods of analysis and design of the concrete containment vessels required for BWR and PWR. A step-by-step critical appraisal of the existing work is given. Elastic, inelastic and cracking conditions under extreme loads are fully discussed. Problems associated with these structures are highlighted. A three-dimensional finite element analysis given by the author is included to cater for service, overload and dynamic cracking of such structures. Missile impact and seismic effects are included in this work. The second analysis is known as the limit state analysis, which is given to design such vessels for any kind of load. Two existing vessels in reinforced and pre-stessed concrete are examined. Substantial calculations are given in order to assess their behaviour. Both these original analyses were developed by the author and are given in the appendices. They have been fully tested on four other vessels and two models. Due to limitations of space, some of these details could not be revealed. A brief explanation is given regarding the computer programs supporting the above analysis. (164 refs.)

70718 Radiation influence on the surroundings in the case of accidential gaseous releases in nuclear power plant. J.Curkovic.
Energija (Yugoslavia), vol.32, no.2, p.89-101 (1983).
Describes methods for estimation of exclusive zone radius and zone of low populations as well as minimal distance to city with more than 2500 inhabitants. For estimation of distances, several presumptions that are included in the AKCDOZ computer program are used. (15 refs.)

70719 Evaluation of fuel performance in reactor (PWR). V. Special behavior caused by cladding defect. T.Aoki (Kansai Electric Power Co., Osaka, Japan).
J. At. Energy Soc. Jpn. (Japan), vol.25, no.2, p.102-7 (Feb. 1983). In Japanese.
For pt.IV see ibid., vol.24, p.29 (1983). Treats the extreme cases, in which recoil and knockout phenomena of fission products from fuel pellets, and surface contamination due to ejected UO_2 may cause abnormal contamination of the primary coolant accompanied by enlargement of the crack in the cladding. For these cases, the transient behavior of iodine concentrations of ^{131}I, ^{133}I and ^{135}I in the primary coolant are analyzed, and variations of relations between ratios of $^{131}I/^{133}I$ and $^{135}I/^{133}I$ are explained. These most unfavorable defects of fuel cladding should be caught by the reactor operator so as to take a suitable and prompt action. The above analysis offers much information to judge the phenomena occurring in the reactors. (18 refs.)

70720 Transient fission product release during dryout in operating UO_2 fuel. I.J.Hastings, C.E.L.Hunt, J.J.Lipsett, R.G.Gray.
Report AECL-7832, Atomic Energy Canada Ltd., Chalk River, Ont. (Dec. 1982), 13 pp.
The authors have irradiated an instrumented stainless-steel-clad UO_2 fuel element, with upper and lower gas lines attached, at a linear power of about 55 kW/m to about 80 MW.h/kg U. During normal operation, fuel central, peripheral and sheath temperatures were about 1700, 800 and 300°C, respectively. During three transients initiated during the test, the corresponding ranges of temperatures were 2000-2300, 1100-1400 and 500-700°C, for dryout times up to 40 min. During normal and transient operation, short-lived xenons and kryptons were swept from the element by a carrier gas and measured by gamma-ray spectrometry. During the most severe transient, fission product release was about 1.8% of inventory, with maximum release during re-wet and a concurrent reactor trip. Despite the thermal shock, the fuel pellets maintained reasonable integrity. No iodines were measured at the spectrometer during normal or transient operation. (16 refs.)

70721 Updating of the plant protection system on the Prototype Fast Reactor Dounreay. D.Hodgson, N.T.C.McAffer (Risley Nuclear Power Dev. Establ., UKAEA, Risley, England).
Colloquium on 'Updating the Control Systems of Existing Plant to Incorporate Microprocessor Technology', London, England, 25 March 1983 (London, England: IEE 1983), p.4/1-6
The Secondary Circuit Interlocks provide control, protection, tripping and inter-tripping of the secondary sodium circuits, the steam generator units, the turbine and feed train, as an operating system. Additional protection such as over current, over temperature, over speed is provided locally for each of the major units. The paper describes the changes and consequences involved in converting the original electro-magnetic relay logic system to a new system based on programmable logic controllers. (2 refs.)

Influence of cladding on the linear elastic RPV analysis during a loss-of-coolant accident .... See Entry 70647

Acoustic emission measurements on large specimens in the research program into component safety (FKS) .... See Entry 70693

Numerical simulation of post-yield fracture mechanics experiments and the possibility of application of results to plant components .... See Entry 70695

Fracture analysis of a pressure vessel with a semi-elliptical surface-crack by three-dimensional elastic-plastic finite element calculation .... See Entry 70696

Test facility for auxiliary cooling system (ACS) of fast breeder reactor for Power Reactor & Nuclear Fuel Development Corporation (PNC) .... See Entry 70711

A new fast neutron scattering technique for local void fraction measurement in two-phase flow .... See Entry 70714

Including plant operating parameters in the remote monitoring systems of nuclear power plants .... See Entry 70727

28.50 FISSION REACTOR TYPES AND APPLICATIONS

70722 CANDU with hydrogen. M.Hammerli (Chalk River Nuclear Labs., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
Int. J. Hydrogen Energy (GB), vol.8, no.4, p.269-80 (1983).
How Canada's successful CANDU (CANada Deuterium Uranium) nuclear power reactors would benefit from an emerging hydrogen-electric economy and vice versa is discussed with reference to the Combined Electrolysis Catalytic Exchange (CECE) process for recovering byproduct heavy water from electrolytic hydrogen. At the heart of this process is a hydrophobic, dispersed-platinum catalyst which has been under development at Chalk River for about a decade. Other potential applications of the CECE process are presented, including tritium recovery from both light and heavy water. Based on preliminary data and cost estimates, the net heavy water dollar credit appears to be at least comparable to the byproduct oxygen credit of electrolytic hydrogen. The potential for byproduct heavy water production from hydrogen in general, and from electroytic hydrogen in particular, is discussed in relation to Canada's present primary heavy water production capacity. (22 refs.)

70723 First nuclear reactor as seen from forty years' perspective. C.A.Dabrowski (Instytut Badan Jadrowych Swierk, Poland).
Przegl. Elektrotech. (Poland), vol.58, no.11-12, p.365-72 (Nov.-Dec. 1982). In Polish.
The most important events in nuclear physics development are presented, which led to the discovery of the feasibility of the nuclear chain reaction on uranium and then to its materialization in the first nuclear reactor commissioned on the 2 Dec. 1942 in Chicago. The three periods in reactor technology development are characterized—development of reactor technology by nuclear powers for military purposes; development of research and experimental reactors; and development of power reactors especially those moderated by graphite. Information on the research and feasibility work of the first Polish natural uranium-graphite power reactors is also given. (28 refs.)

Application of the ASME-code-case N 47 to a typical thick-walled HTR-component made of Incoloy 800 .... See Entry 70645

Oxide stripping from AGR fuel can by sputter ion plating (SIP) .... See Entry 70650

Dynamic analysis simulator and condensate demineralizer operation of the radioactive waste treatment system for a BWR power plant ... See Entry 70652

Materials available and the present state of research into the basis for the design of high temperature components for HTR-plants .... See Entry 70688

Description of the properties of 10CrMoNiNb910 .... See Entry 70689

Recording length-criteria used for ultrasonic testing .... See Entry 70691

Fuel streams in closed-cycle light water reactors .... See Entry 70706

An evaluation of approximate methods for calculating anisotropic flux escape and transmission probabilities for cylindrical annular regions .. See Entry 70708

Modification of the PWR control system using a gaseous absorber .... See Entry 70709

Test facility for auxiliary cooling system (ACS) of fast breeder reactor for Power Reactor & Nuclear Fuel Development Corporation (PNC) .... See Entry 70711

ZED-2 experiments on the effect of a Co absorber rod on an NRU loop .... See Entry 70713

Monte Carlo simulation of the emergency shutdown system for the high-temperature pebble-bed nuclear reactor .... See Entry 70715

PWR nozzle 'crotch corner' inspection: an effective additional ultrasonic technique for radial cracks .... See Entry 70716

Containment vessel design and practice .... See Entry 70717

Evaluation of fuel performance in reactor (PWR). V. Special behavior caused by cladding defect .... See Entry 70719

Updating of the plant protection system on the Prototype Fast Reactor Dounreay .... See Entry 70721

Effect of oxidizing environment on the strength of H451, PGX and IG-11 graphites .... See Entry 73167

28.52 FUSION REACTORS

(for confinement, see 52.55)

70724 The JET scientific programme and perspectives in the European fusion programme. R.J.Bickerton (JET Joint Undertaking, Abingdon, England).
Phys. Scr. (Sweden), vol.T2, no.2, p.347-52 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The JET scientific programme is aimed at the achievement of a deuterium-tritium plasma with parameters close to those evisaged for a fusion reactor. The programme is paced and largely determined by the gradual build-up over four years of the additional heating power into the plasma. The present expectation is that it will be possible to reach conditions where the thermonuclear power in alpha particles makes a significant contribution to the energy balance in the core of the JET plasma. The JET experiment is placed in the context of the European fusion programme and the desiderata and time scales for a large post-JET tritium-burning Tokamak (Next European Torus, NET) are deduced. (9 refs.)

70725 Physics requirements for a Tokamak Engineering Test Reactor. D.Duchs (Max-Planck-Inst. fur Plasmaphys., Garching, Germany), F.Engelmann.
Phys. Scr. (Sweden), vol.T2, no.2, p.353-8 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The physics requirements of a Tokamak Engineering Test Reactor, considered as the step following the generation of large Tokamaks presently under construction in developing a fusion reactor, are concisely stated and discussed, using as starting point the analysis of the INTOR Workshop. (4 refs.)

Deuterium separation by multiple-photon dissociation of 2,2-dichloro-1, 1, 1-trifluoroethane in a two-frequency CO_2 laser field .... See Entry 71027

Separation of Li isotopes by laser deflection of atomic beam .. See Entry 71028

Reflective optics system for multiple beam laser fusion .... See Entry 71171

Early history .... See Entry 71730

Ignition of a laser target by a focused shock wave .... See Entry 71764

The physics of mirror systems .... See Entry 71777

The physics of the dense Z-pinch in theory and in experiment with application to fusion reactor .... See Entry 71779

Crystals containing a high density of lattice defects after heavy irradiation .... See Entry 72004

28.70 NUCLEAR EXPLOSIONS

(see also 47.40 Shock and detonation phenomena)

Seismic event discrimination .... See Entry 73729

Test ban treaty verification with regional data—a review .... See Entry 73730

Estimating the yield of underground nuclear explosions .... See Entry 73731

Application of arrays in the detection, location, and identification of seismic events .... See Entry 73733

An application of syntactic pattern recognition to seismic discrimination .... See Entry 73744

The resolution of seismic instruments used in treaty verification research .... See Entry 73928

28.80 RADIATION TECHNOLOGY, INCLUDING SHIELDING

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

70726 Radiation and risk. W.Jacobi.
Atomwirtsch.-Atomtech. (Germany), vol.28, no.5, p.238-48 (May 1983). In German.
From the beginnings of the peaceful utilization of nuclear energy, the principles of prevention and optimization have greatly limited the emission of radioactive substances. In this way, the radiation exposure associated with emissions from nuclear power plants during normal operation has been kept low compared with natural radiation exposure and its variance. This also applies to the local public in the vicinities of such plants. The present health hazard to the public arising from ionizing radiation is only a small fraction of the man-made risk to which the public is exposed in this country. This is also due to the fact that radiation protection employs the principle of prevention, which has been laid down in legal regulations. In this respect, the concepts and criteria developed in radiation protection for evaluation, limitation and optimization may be useful examples to other areas of safety at work and environmental protection. The acceptance of nuclear power is decisively influenced by the remaining residual risk of accidents. Extremely careful inspection and supervision of the technical safety of such plants is indispensable to prevent major accidents. The German risk study for nuclear power plants has made an important contribution to this end. It is being continued. However, risk research must always be accompanied by risk comparison to allow numerical risk data to be evaluated properly and important features to be distinguished from unimportant ones. (26 refs.)

70727 Including plant operating parameters in the remote monitoring systems of nuclear power plants. P.Tolksdorf, H.Wolf.
Atomwirtsch.-Atomtech. (Germany), vol.28, no.5, p.264-8 (May 1983). In German.
Automatic remote monitoring systems for nuclear power plants are already operated in the German Federal States of Bavaria, Lower Saxony, and Schleswig-Holstein. In the other Federal States with nuclear power plants under construction and in operation, decisions have been taken to install such remote monitoring systems. These systems are intended to monitor the emissions of radioactive substances associated with the operation of nuclear power plants. Since the issuance by the State Committee on Atomic Energy of a general recommendation of remote monitoring there has been a discussion about the need to include in this remote monitoring also plant operating parameters of nuclear power stations and, if so, these criteria are (1) the activity inventory in the plant and the critical magnitudes of releases, (2) the integrity of the safety barriers and containment of the activity inventory, and (3) the retention of radioactive materials and identification of potential release pathways. (6 refs.)

70728 Applications of optical fibers to analog telemetry delay lines and sensing systems. P.B.Lyons (Los Alamos Nat. Lab., Los Alamos, NM, USA), S.D.Personick, G.A.Hayward.
IEEE J. Sel. Areas Commun. (USA), vol.SAC-1, no.3, p.555-61 (April 1983).
Describes requirements for a broad-band analog telemetry link for nuclear test monitoring. The authors also describe prototype hardware developed to meet these requirements. (5 refs.)

70729 Controlling radiation exposures in nuclear plants. M.D.Naughton, R.A.Shaw, C.J.Wood (Electric Power Res. Inst., Palo Alto, CA, USA).
Power (USA), vol.127, no.4, p.99-102 (April 1983).
A major industry research program is tackling radiation fields created outside the core. Its goal is to develop practices to prevent their formation, and methods to remove offending sources already present. (7 refs.)

70730 Radiation processing dosimetry. W.L.McLaughlin (Center for Radiation Res., NBS, Washington, DC, USA).
Radiat. Phys. & Chem. (GB), vol.21, no.4, p.359-66 (1983).
Measurements of ionizing radiation quantities of intense photon and electron radiations are used to establish quality control of industrial radiation processes. The most important quantity is absorbed dose as determined through traceability of routine dosimetry to calorimetry or standard chemical dosimetry. Some crucial concerns of dosimetry are: (1) calculations and measurements of radiation energy depositions; (2) improved radiation interac-

tion data in condensed media; (3) radiation scattering behavior for different substances and spectral distributions; (4) secondary radiation phenomena at boundaries and in dielectrics; (5) environmental effects on dosimetry response and analysis. (50 refs.)

70731 Dose conversion factors for intakes of selected radionuclides by infants and adults. J.R.Johnson, D.W.Dunford.
Report AECL-7919, Atomic Energy Canada Ltd., Chalk River, Ont. (Jan. 1983), 32 pp.
Since an earlier report on this subject was written in 1979 the International Commission on Radiological Protection (ICRP) has completed its review of its recommended models for internal dosimetry and has published extensive data used in their calculations of annual limits on intake for workers. In addition, age dependent models to calculate doses for several elements have been improved, new dosimetry factors have become available in computer readable form, several papers describing the derivation and use of dose conversion factors have been published and errors and omissions in tables included with the 1979 report have been identified. It was therefore decided to rewrite this report, taking into account the ICRP recommended models and model parameters, the new dosimetry factors, and the new age dependent models. As in the previous report, the committed effective dose equivalent and the committed dose equivalent to the organ receiving the highest dose per unit intake by Reference Infant (the one year old) and Reference Man are given. The revised format of the tables containing this information should make this report considerably easier to use than was the original. (30 refs.)

The function of waste immobilization as a barrier against radionuclide release in the frame of an overall risk assessment .... See Entry 70656

Investigation of activity release from bituminized intermediate-level waste forms under thermal stresses .... See Entry 70679

A study of certain properties of bitumen compounds which determine the conditions for their storage .... See Entry 70680

The role of waste conditioning as regards the safety of low-and intermediate-level waste disposal .... See Entry 70684

Respirable fines produced by impacts of simulated alternative high-level waste materials .... See Entry 70702

Radiation influence on the surroundings in the case of accidental gaseous releases in nuclear power plant .... See Entry 70718

Preparation and applications of $Li_2B_4O_7$(Cu)TLD .... See Entry 73667

Radiation Protection. Eighth Symposium on Microdosimetry (EUR 8395 EN) . ... See Entry 73669

28.90 OTHER TOPICS IN NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

Treatment, storage and disposal of low- and intermediate-level reactor wastes at Olkiluoto Power Plant .... See Entry 70683

The role of waste conditioning as regards the safety of low-and intermediate-level waste disposal .... See Entry 70684

29.00 EXPERIMENTAL METHODS AND INSTRUMENTATION FOR ELEMENTARY-PARTICLE AND NUCLEAR PHYSICS

29.15 ELECTROSTATIC AND LINEAR PARTICLE ACCELERATORS

A new accelerator-based mass spectrometry .... See Entry 70142

29.20 CYCLIC ACCELERATORS AND STORAGE FACILITIES

(for plasma accelerators, see 52.75)

70732 Nonlinear theory of the compression of a relativistic electron beam by coherent electromagnetic radiation. Yu.P.Bliokh, I.N.Onishchenko, Ya.B.Fainberg.
Fiz. Plazmy (USSR), vol.9, no.2, p.389-91 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
A nonlinear theory of the excitation of electromagnetic waves in a relativistic electron beam by betatron oscillations of electrons in the self magnetic field of the beam is presented. It is shown that the beam is compressed so long as field amplitude of the wave being excited does not reach a maximum value determined by the capture of electrons. (5 refs.) *A.G.C.*

70733 Progress report on the Daresbury Laboratory Synchrotron Radiation Facility. K.R.Lea (Sci. & Engng. Res. Council, Daresbury Lab., Daresbury, England).
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.35-6
The Synchrotron Radiation Source (SRS) at Daresbury, is now in its second year of scheduled operation. Ten experimental stations on four beam ports have been used to date (August 1982) for research programmes in X-ray, VUV, UV and infrared spectral regions. Several more stations are close to completion. These include three for atomic and molecular spectroscopy on beamline 3, one for powder diffraction, and others to supplement existing provision for EXAFS, protein crystallography, small angle scattering, X-ray interferometry, and photoemission. Hard X-ray radiation ($\lambda_c=0.93$ Å) has been obtained from the wiggler magnet (a 3-pole superconducting device with a central field of 5.0 Tesla) and a 7-station wiggler beamline is under construction. Single bunch operation of the storage ring is under development, to provide ~0.2 nsec light pulses at 320 nsec intervals; further work to eliminate weak parasitic bunches is proving necessary before good time-resolved spectroscopic data can be taken. (no refs.)

70734 SSRL: operations and research. P.Pianetta, I.Lindau (Stanford Synchrotron Radiation Lab., Stanford Univ., Stanford, CA, USA).
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.39-40
This is a brief synopsis of some of the highlights of research results and major instrument improvements at SSRL during the past year. (no refs.)

70735 Current beamline status of Aladdin. C.H.Pruett (Synchrotron Radiation Center, Stoughton, WI, USA).
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.41-2
The parameters of Aladdin are exceptionally good for a source of synchrotron radiation extending up to approximately 4 KeV. With a smaller source size and higher output flux than Tantalus, Aladdin should be much more productive than the smaller machine. At the present time 16 out of the total of 36 beam ports have been assigned for implementation by the SRC staff and by Participating Research Times (PRTs). Ten of the ports will be implemented by the SRC and six by PRTs. In addition three beamlines have been proposed by PRTs and are awaiting final design and/or funding. The remaining 17 ports are uncommitted at present. (no refs.)

70736 Progress report—Aladdin. E.M.Rowe (Synchrotron Radiation Center, Stoughton, WI, USA).
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.43-6
During the nine months December 1, 1981 through August 31, 1982, progress on commissioning Aladdin has been slow but steady. (no refs.)

29.25 PARTICLE SOURCES AND TARGETS, PREPARATION AND TECHNOLOGY

(see also 07.77 Particle production and handling; targets)

70737 Applied-B field ion diode studies at 3.5 TW. D.J.Johnson, P.L.Dreike, S.A.Slutz, R.J.Leeper, E.J.T.Burns, J.R.Freeman, T.A.Mehlhorn, J.P.Quintenz (Sandia Nat. Labs., Albuquerque, NM, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2230-41 (May 1983).
The performance of 7 and 14 cm radius, applied *B*-field, focusing ion diodes is investigated on the Proto II accelerator at a diode power of 3.5 TW. The ion production efficiency of the 14-cm diode is determined to be approximately 80% for the 30-ns power pulse used. When a 2 Torr air background gas was used in the beam propagation region between the diode and the target, the ion beam was observed to be approximately 70% magnetically neutralized in regions of approximately 20 kG transverse *B*-field and $\geq 95\%$ in regions of no *B*-field. The local and global divergence of the 1.4-MV beam were each determined to be approximately 1°. Local source power brightness of $>1.5\times10^{13}$ W/cm^2/rad^2 is inferred. (18 refs.)

70738 Direct observation of fermion spin superposition by neutron interferometry. J.Summhammer, G.Badurek, H.Rauch (Atominst. der Osterreichischen Univ., Wien, Austria), U.Kischko, A.Zeilinger.
Phys. Rev. A (USA), vol.27, no.5, p.2523-32 (May 1983).
The coherent superposition of oppositely polarized neutron beams of equal amplitude results in a final beam polarization perpendicular to the polarization of both initial beams. This polarization can be rotated by purely scalar interaction applied to the beams before superposition, which is equivalent to an additional Larmor precession applied to the beam after superposition. The authors have directly observed these effects in an experiment performed using the perfect-crystal neutron interferometer at the high-flux reactor at Grenoble. This paper gives the experimental results and discusses their theoretical foundation. (28 refs.)

70739 Measurement of linear polarization of high-energy photon beams. E.A.Vinokurov, V.F.Boldyshev.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.492-7 (April 1983). In Russian.
It is shown that in track device triplet photoproduction with selection of events within a suitable range of invariant mass values of the pair permits are to obtain a high (up to 96%) asymmetry of the recoil-electron distribution and thereby to optimize photon-beam linear polarization measurements. (20 refs.)

Ion source of ROMS-2 mass spectrometer with fragmentless ionization .... See Entry 70141

Application of physical effects for the detection of small ion currents in vacuum .... See Entry 70150

Continuous-running electron gun with a large-area plasma cathode .... See Entry 70152

Measurement of the energy spectrum of nanosecond X-ray pulses .... See Entry 70163

Nonlinear theory of the compression of a relativistic electron beam by coherent electromagnetic radiation .... See Entry 70732

Progress report on the Daresbury Laboratory Synchrotron Radiation Facility .. .. See Entry 70733

Current beamline status of Aladdin .... See Entry 70735

Progress report—Aladdin .... See Entry 70736

Travelling wave coronas as ion source .... See Entry 71834

29.30 RADIATION SPECTROMETERS AND SPECTROSCOPIC TECHNIQUES

70740 Determination of reactor neutron spectra with multicomponent activation detectors. J.V.Sandberg, P.D.Lund (Dept. of Tech. Phys., Helsinki Univ. of Technol., Espoo, Finland).
J. Radioanal. Chem. (Switzerland), vol.76, no.1, p.151-70 (1983).
A procedure is described for the functional fitting of reactor neutron spectra with C/E^n and fission spectra. The method is applied to multicomponent activation detector measurements in a Triga research reactor. In multicomponent detectors a mixture of several detector materials is irradiated as a single unit and measured simultaneously for all reaction products with a Ge(Li) gamma ray spectrometer. (21 refs.)

70741 A Compton suppression gamma-ray spectrometer for low level counting. I. Radioanalytical evaluation. J.op de Beeck, A.Isebaert, J.Hoste (Inst. for Nuclear Sci., Rijksuniv. Gent, Gent, Belgium).
J. Radioanal. Chem. (Switzerland), vol.76, no.1, p.225-39 (1983).
A Compton suppression gamma-ray spectrometry system has been evaluated for its use as a low level radioactivity counting facility. The system consists of a premium quality Ge(Li) detector surrounded by a shield of NaI(Tl) detec-

tor material. Compton suppression is obtained by operating the two detector systems in anti-coincidence. Spectrum collection hardware consists of a NP11-A (DEC) interface for two ADCs and a PDP 11/T 10 minicomputer with 64 K byte core memory. Software development and system operation modes are described. System performance as a function of physical characteristics of the sample, scattering angle and gamma-photon energy, is discussed. Continuum reduction for cascaded gamma-transitions and natural background are considered separately. (11 refs.)

70742 In-beam gamma-ray spectroscopy with heavy ions. D.Pelte (Phys. Inst., Univ. Heidelberg, Heidelberg, Germany), D.Schwalm.
In book: *Heavy ion collisions. Vol.3,* R.Bock [Ed.], p.1-297. Amsterdam, Netherlands: North-Holland (1982), x+666 pp. [0 444 85352 9]
The authors begin with some theoretical background to their subject matter. This includes sections on electromagnetic properties of nuclear states, nuclear model predictions, and angular correlations and distributions. Experimental aspects of in-beam gamma-ray spectroscopy are discussed, including the detection of gamma-rays, and the general properties and analysis of gamma-ray spectra. The final section describes methods used in in-beam gamma-ray spectroscopy with heavy ions, discussing reaction mechanism studies and nuclear structure studies. (202 refs.)

70743 Probing nuclei far from stability with heavy ions. J.H.Hamilton (Phys. Dept., Vanderbilt Univ., Nashville, TN, USA).
In book: *Heavy ion collisions. Vol.3,* R.Bock [Ed.], p.573-665. Amsterdam, Netherlands: North-Holland (1982), x+666 pp. [0 444 85352 9]
The author looks first at the advantages which heavy ions offer as probes, in studying nuclei far off stability. There are sections on nuclear mass studies, beta delayed particle emissions, alpha and proton radioactivities, gamma ray and conversion electron spectroscopy, laser spectroscopy and the synthesis of heavy and superheavy nuclei. (333 refs.)

70744 Sulfur isotopes identification by Bragg curve spectroscopy. D.Fabris, F.Gramegna, I.Iori, A.Moroni, G.Nebbia, G.Prete, R.A.Ricci, G.Viesti (Istituto Lab. Nazionale di Fisica Nucleare, Lab. Nazionali di Legnaro, Legnaro, Italy).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.47
The Bragg Curve Spectroscopy (BCS) is an alternative utilization of the ionization chamber. In principle it should allow both mass and charge identification by measuring the parameters characterizing the Bragg curve of the heavy ions stopped in the detector gaseous medium. The authors report on the discrimination between sulfur isotopes using a BCS ionization chamber at the Legnaro Tandem Laboratory. (2 refs.)

Heavy ion collisions. Vol.3 ....See Entry 69804

A new accelerator-based mass spectrometry ....See Entry 70142

Optimisation of electron energy analysers for application in coincidence experiments ....See Entry 70153

Measurement of the energy spectrum of nanosecond X-ray pulses ....See Entry 70163

Comparison of the spectrometric characteristics of the FEU-110, FEU-139, and RCA 4524 photomultipliers ....See Entry 70747

29.40 RADIATION DETECTORS

(for mass spectrometers, see 07.75)

70745 Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector. M.L.Cherry, I.Davidson, K.Lande, C.K.Lee, E.Marshall, R.I.Steinberg (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA).
AIP Conf. Proc. (USA), no.96, p.248-64 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
The Homestake Gold Mine presently houses the Brookhaven solar neutrino experiment and a 300-ton water Cerenkov detector at a depth of 4200 meters water equivalent. The Cerenkov detector has been used to study nucleon decay, multiple muons, and neutrino bursts. An array of liquid scintillator, with surface area of 130 m^2, is presently being constructed to measure magnetic monopoles, neutrino oscillations, underground muons, and neutrino bursts. At the same time, a 1 km^2 extensive air shower array is being built on the surface in order to measure the high energy cosmic ray composition with simultaneous surface and underground shower measurements. Future plans call for a 1406-ton liquid scintillator Tracking Spectrometer to measure nucleon decay, n-n̄ transitions, and the low energy cosmic ray neutrino spectrum. The authors describe the present results and the possibilities for physics other than nucleon decay in the nucleon decay detectors. (19 refs.)

70746 A plasmochemical model of self-quenching Geiger-Muller counters. S.I.Ivanov, A.T.Peeva (Faculty of Phys., Univ. of Sofia, Sofia, Bulgaria), T.I.Karatoteva.
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.116-22 (1983).
A plasmochemical model of a self-quenching GM counter containing inert gas and quenching components is proposed based on the assumption that the counter is identical in chemical and, to a certain extent, in electrical respect with the static reactor with corona discharge for plasma polymerization of organic vapours. It is assumed that dissociation and polymerization reactions of the quenching component take part in the counter and that these reactions produce ultimately unreactive species. A set of equations is proposed for describing the changes in the gas mixture during the operation of the counter. The possible changes in the reagents and gas products concentrations as well as of the total pressure in the counter have been studied. The model proposed has been confirmed by experimental data obtained during studies on polymeric species deposited on the anode of an aged counter with a gas mixture containing inert gas argon and quenching component methylal, ethanol and isopentane. (8 refs.)

70747 Comparison of the spectrometric characteristics of the FEU-110, FEU-139, and RCA 4524 photomultipliers. S.D.Kalashnikov, V.L.Krivoshein (All-Union Sci.-Res. Inst. of Medical Instrumentation, Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.990-2 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR),* vol.25, no.4, p.190-1 (July-Aug. 1982). [received: May 1983]
The results of measurements of the energy resolution of the FEU-139 photomultiplier (PM) are reported; this PM has an antimony potassium cesium photocathode of diameter 63 mm, and the measurements are performed with an NaI(Tl) spectrometric detector of diameter 63×63 mm using gamma-radiation energies of 60 keV (^{241}Am), 122 keV (^{57}Co), and 662 keV (^{137}Cs). In terms of its spectrometric characteristics, the FEU-139 is superior to the FEU-110 and is on a par with its foreign-made counterpart, the RCA 4524. (1 ref.)

70748 Microdefects in X-ray radiation detectors. V.P.Gimanov, L.A.Kholodova, D.A.Goganov, E.V.Blyakher, V.V.Korolev, E.V.Solov'eva.
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1022-4 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR),* vol.25, no.4, p.218-21 (July-Aug. 1982). [received: May 1983]
The spectrometric characteristics of Ge radiation detectors and structural defects in the initial Ge were investigated. It was found that detectors which are made from dislocation-free Ge exhibit better spectrometric and electrophysical characteristics than those made from Ge with dislocations: intense spurious lines in the recorded spectra are missing, and the voltage of operation is increased by a factor of 3-5. (3 refs.)

70749 Responses of some solid state nuclear track detectors to high-energy neutrons and protons. F.Spurny, K.Turek (CSAV, Praha, Czechoslovakia).
Jad. Energ. (Czechoslovakia), vol.29, no.4, p.141-5 (April 1983). In Czech.
Responses of some solid state nuclear track detectors (SSNTDs) in the neutron and proton beams of the synchrocyclotron of the Laboratory of Nuclear Problems of the Joint Institute of Nuclear Research, Dubna—USSR was established. The responses of some polymer SSNTDs without an external charged particle radiator and also with a radiator of fission (or spallation) fragments (Au, Bi, Th, U) were studied. The responses of a glass SSNTD were established only for the detector in contact with a fragment radiator. The SSNTDs studied were treated by chemical as well as electrochemical etching. The responses obtained are analyzed and compared with some published data. Some possibilities of the use of such detectors fdor high-energy particle detection and dosimetry are also discussed. (17 refs.)

70750 A low pressure drift chamber for the neutron radiography. J.V.Zanevsky, Z.Moucka, T.Netusil, V.D.Peschov, B.Sitar.
Jad. Energ. (Czechoslovakia), vol.29, no.4, p.148-52 (April 1983). In Russian.
Describes a low pressure drift chamber in which space coordinates of two points on an alpha-particle track are determined. By means of these coordinates and using reconstruction of the alpha-particle track outgoing from the (n, alpha) reaction, the neutron conversion point in the convertor can be determined by simple calculation. (3 refs.)

70751 Helium streamer chamber with laser track registration at gas pressures of up to 5 atm. A.Budziak, N.P.Bobrova, I.V.Falomkin, V.I.Lyashenko, G.B.Pontecorvo, A.G.Potekhin, V.Z.Serdyuk, Yu.A.Shcherbakov (Joint Inst. for Nuclear Res., Dubna, USSR), D.Sporea, M.V.Stabnikov, M.A.Tombak, K.Zeliger.
Opt. Appl. (Poland), vol.12, no.3-4, p.461-70 (1982).
Shows that the particle track detection with a laser can be successfully performed in a helium chamber at helium pressures of up to 5 atm, if some insignificant admixtures of methane and water vapours are let into the chamber. (13 refs.)

70752 Further improvements in the design of a positron camera with dense drift space MWPC's. R.Bellazzini, A.Del Guerra, M.M.Massai, W.R.Nelson, V.Perez-Mendez, G.Schwartz, G.Spandre.
Report INFN/TC-83/5, Ist. Naz. Fis. Nucl., Pisa, Italy (24 Feb. 1983), 4 pp.
The authors describe the improvements achieved in the last three years towards the construction of a large solid angle Positron Camera with dense drift space MWPCs. A multiplane three-dimensional Tomograph is proposed, made of six MWPC modules (active area 45×45 cm^2 each), arranged to form the lateral surface of a hexagonal prism. Its expected performance is presented and is shown to be very competitive with the multiring scintillator Positron Camera. (8 refs.)

70753 Diogene, a 4-π detector for light charged particles emitted in relativistic heavy ion collisions. J.P.Alard (LPC, Clermont-Ferrand, France), J.Augerat, R.Babinet, F.Brochard, Y.Cassagnou, J.P.Costilhes, L.Fraysse, J.Girard, P.Gorodetzky, J.Gosset, J.Julien, C.Laspalles, M.C.Lemaire, D.L'hote, B.Lucas, G.Montarou, A.Papineau, M.J.Parizet, J.Poitou, C.Racca, J.C.Tamain, Y.Terrien, H.Ueno.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.27
Diogene is a detector with a solid angle close to 4π. It is essentially made of a time projection chamber and is able to detect in coincidence a few tens of charged light particles emitted in relativistic heavy ion collisions. Curvature of the trajectories, induced by an axial magnetic field, associated to the energy loss in the detector gas, allows one to distinguish the different masses relative to a given charge. A trigger, made of 30 boards of plastic scintillator arranged as a barrel, surrounds the detector. Diogene's construction is just finished and the last tests with beam (α particles) are being processed. A plastic wall located at 0°, analogous in conception to the Berkeley one associated with the Plastic Ball, is being joined to Diogene. This wall is a complement trigger (time of flight) and a complement to the solid angle not seen by Diogene in the forward direction. It is under construction. The whole assembly should be operational in 1983, when Saturne II in Saclay will deliver relativistic heavy ions. (no refs.)

The Si photodiode: an inexpensive though high-performing α detector ....See Entry 69825

Determination of reactor neutron spectra with multicomponent activation detectors ....See Entry 70740

Measurement of 3γ annihilation of positron using Ge(Li) detector ....See Entry 72883

29.60 COUNTING CIRCUITS AND NUCLEAR ELECTRONICS

70754 Measurement of the time-of-flight spectrum of a supersonic beam with an AI-128-2 multichannel pulse-height analyzer. F.F.Papp, E.E.Kontrosh, N.I.Romanyuk, A.V.Snegurskii, A.N.Zavilopulo (Uzhgorod Univ., Uzhgorod, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.975-6 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR),* vol.25, no.4, p.176-8 (July-Aug. 1982). [received: May 1983]
A circuit is described for use in an AI-128-2 multichannel pulse-height analyzer to measure the velocity distribution and analyze the time-of-flight spectrum. Automatic time analysis improves the method of measurement and raises the reliability of the results. (3 refs.)

29.70 RADIATION MEASUREMENT, DETECTION AND COUNTING

(see also 29.30 Radiation spectrometers and spectroscopy, 29.40 Radiation detectors; for dosimetry, see 87.60M)

A device for measuring the electrical potential in an insulator .... See Entry 70081

Device for measuring the energy reflection coefficient in charged-particle bombardment of a metal .... See Entry 70148

Optimisation of electron energy analysers for application in coincidence experiments .... See Entry 70153

Radiation processing dosimetry .... See Entry 70730

In-beam gamma-ray spectroscopy with heavy ions .... See Entry 70742

Microdefects in X-ray radiation detectors .... See Entry 70748

Calculated gamma-ray and/or neutron attenuation coefficients in 14 MeV neutron activation analysis .... See Entry 73386

30.00 ATOMIC AND MOLECULAR PHYSICS

(for physical chemistry, see 82.)

31.00 THEORY OF ATOMS AND MOLECULES

(see also 71. Electron states in condensed matter)

70755 Bill Bright Memorial Lecture—models for conduction in molecular solids. T.J.Lewis (School of Electronic Engng. Sci., Univ. Coll. of North Wales, Bangor, Wales).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.129-40
Modern concepts concerning the electronic states of molecular solids are examined. The importance of localised molecular ion states and of local polarization relaxation in determining their energies is emphasised. The weak interactions of these states and the associated static and dynamic disorder leads to the conclusion that charge transport proceeds by tunnelling, a highly vectorial process, which gives rise to characteristic low mobility. The general features of contact electrification follow naturally from the model. The future development of molecular conductors rather than insulators will be based on these concepts. (18 refs.)

31.10 GENERAL THEORY OF STRUCTURE, TRANSITIONS AND CHEMICAL BINDING

70756 Energy components and relationships for homonuclear diatomics. G.I.Plindov (Nuclear Power Engng. Inst., Acad. of Sci., Minsk, Belorussian SSR), S.K.Pogrebnya.
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.14-18 (6 May 1983).
On the basis of the Thomas-Fermi theory and the virial and Hellmann-Feynman theorems, some new energy relationships for homonuclear diatomics are obtained. The estimation of energy components is given in universal form. (13 refs.)

70757 A model of the electronic configuration of atoms, and a mathematical formulation for the periodic system of elements. A.Shima (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan).
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.31-47 (1983).
A rule of the filling of electron shells for general elements including an electronic configuration of superheavy elements is presented, and based on this rule, a new model with periodicity for the electronic configuration of elements is proposed. From this result a super-long periodic table up to $Z=362$ is obtained. A general equation for electronic configuration of atoms is found by conducting a mathematical formulation for the periodic system of elements. (10 refs.)

Formulas, facts and constants. For students and professionals in engineering, chemistry and physics .... See Entry 69803

31.15 GENERAL MATHEMATICAL AND COMPUTATIONAL DEVELOPMENTS

70758 A uniform WKB approximation for spheroidal wave functions. M.L.Sink, Byung Chan Eu (Dept. of Chem., McGill Univ., Montreal, Quebec, Canada).
J. Chem. Phys. (USA), vol.78, no.8, p.4887-95 (15 April 1983).
Uniform WKB wave functions are developed for prolate spheroidal wave functions which arise when the Schrodinger equation is given in prolate spheroidal coordinates. A detailed numerical test is presented for angular spheroidal wave functions. It shows that the approximate uniform WKB wave functions are excellent in accuracy. (10 refs.)

70759 Λ-type doubling and term formulae for a $^5\Pi$ state in the intermediate case between Hund's cases (a) and (b). I.Kovacs (Dept. of Atomic Phys., Tech. Univ., Budapest, Hungary).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.41-7 (March 1983).
Explicit expressions valid for all values of Y intermediate between Hund's cases (a) and (b) are obtained for the multiplet term formula and for the width of the Λ-type doubling of $a^5\Pi$ state. (10 refs.)

31.20 SPECIFIC CALCULATIONS AND RESULTS

70760 Calculations of medium effects on absorption and emission spectra by SCRF theory. F.Zuccarello, A.Raudino, G.Buemi (Istituto Dipartimentale di Chimica, Univ. di Catania, Catania, Italy).
THEOCHEM (Netherlands), vol.10, p.265-70 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The self consistent reaction field (SCRF) theory inserting the reaction field approach into the Hartree-Fock formalism, allows one to calculate the variations in the wavefunctions of a molecule experiencing the action of whatever polarizable external medium. The authors used this method to study the solvent shifts in the absorption and emission spectra of the isomeric molecules, pyridazine, pyrimidine and pyrazine. (6 refs.)

70761 *LS* term-dependent and configuration-average Hartree-Fock calculations for complex atoms and ions. D.C.Griffin (Rollins Coll., Winter Park, FL, USA), M.S.Pindzola.
Comments At. & Mol. Phys. (GB), vol.13, no.1, p.1-18 (1983).
Discusses the calculation of atomic structure for complex atoms and ions using wave-functions constructed from Hartree-Fock radial functions. In particular, the authors consider two approaches to such calculations: one involves the use of configuration-average radial functions, and the other employs *LS* term-dependent radial functions. Although these methods have been applied to such problems for many years, their use and interpretation continue to cause confusion within the current literature. (35 refs.)

70762 Optimisation of multi-configuration self-consistent field (MCSCF) orbitals. II. Calculation of total pi-electron energies and dipole moments of some non-alternant hydrocarbons. P.R.Ray, N.G.Mukherjee (Chem. Dept., Univ. Coll. of Sci., Calcutta, India).
Indian J. Chem. A, vol.21A, no.9, p.864-8 (Sept. 1982). [received: May 1983]
A multi-configuration self-consistent field (MCSCF) procedure developed earlier by the authors has been used for the calculation of total pi-electron energies and dipole moments of some non-alternant hydrocarbons. Results show a consistent improvement over the SCF and SCFCI results. Analysis of the choice of excited configurations shows that a major improvement can be achieved by considering only a few low-lying excited states. (16 refs.)

70763 N-N bond in dinitrogen tetroxide. C.W.Bauschlicher, A.Komornicki, B.Roos (Polyatomics Res. Inst., Mountain View, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.4, p.745-8 (23 Feb. 1983).
Dinitrogen tetroxide is a weakly bound dimer of NO_2, whose geometrical and electronic structure has been the subject of numerous experimental and theoretical investigations over the past 30 years. The molecule is characterized by two NO_2 groups whose geometrical parameters are virtually identical with those found in free NO_2 and a very long, 1.78 Å, N-N bond. Previous calculations have been unable to reproduce this geometrical structure. The authors report the results of a series of CAS-SCF calculations which employ a double-ζ plus polarization quality basis set. Their extensive CAS-SCF calculations, which include 18 electrons correlated in 12 valence orbitals, not only reproduce the known experimental geometry but also show that a proper description for N_2O_4 is associated with a correct description of the individual NO_2 fragments. (20 refs.)

70764 Penetration effects in 'non-penetrating' states. C.E.Theodosiou (Dept. of Phys. & Astron., Univ. of Toledo, Toledo, OH, USA).
J. Phys. B (GB), vol.16, no.10, p.L309-12 (28 May 1983).
Energy shifts due to the core penetration by Rydberg state electrons are usually small. It is pointed out, however, that they should be appropriately included if high-accuracy spectroscopic analyses are desired. The author examines these effects for the f and g states of neutral C, N, O and Ne and he finds that corrections due to penetration lower the polarisability values, in better agreement with ab initio theoretical predictions. (7 refs.)

70765 The empirical general harmonic force field of ethane. J.L.Duncan, R.A.Kelly (Dept. of Chem., Univ. of Aberdeen, Aberdeen, Scotland), G.D.Nivellini, F.Tullini.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.87-110 (March 1983).
A total of 175 spectroscopic data, accumulated from 10 isotopic species of ethane, are used to define all 22 parameters of the harmonic potential function within narrow limits. Before calculation, numerous Fermi resonances have been identified and quantified through infrared and Raman spectroscopic studies of CH_3CD_3 and its ^{13}C isotopic species. This is an essential prerequisite to such an investigation, without which a self-consistent empirical data set cannot be achieved from which to determine physically meaningful force constants. Comparison of the empirical force constants with those predicted by scaled ab initio calculations shows an excellent degree of correspondence in all force constants, and confirms that both approaches can lead to essentially identical results. Calculated values of spectroscopic data of reliable quality are listed. These should be of value to future spectroscopic investigation of isotopic ethanes and for resolving the many resonance perturbations which are present. (26 refs.)

70766 Self-consistent field vibrational energies for a system of coupled oscillators using the hypervirial and the Hellmann-Feynman theorems. A.Requena, R.Pena (Phys.-Chem. Dept., Murcia Univ., Murcia, Spain).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.471-5 (May 1983).
A self-consistent field description of coupled anharmonic oscillators is proposed to obtain energy eigenvalues by using the hypervirial and Hellmann-Feynman theorems. The equations are solved numerically for a model of two anharmonic oscillators, which describes the normal vibration of a pair of coupled oscillators. The results are compared with numerical calculations that have been previously carried out for this system. (11 refs.)

70767 Relation between total energy, electronic potential at the nucleus and chemical potential. Application to the helium isoelectronic series in Hartree-Fock theory. L.C.Balbas (Dept. de Optica, Univ. de Valladolid, Valladolid, Spain), J.A.Alonso, M.L.Zorita.
Phys. Lett. A (Netherlands), vol.95A, no.2, p.89-91 (18 April 1983).
A formal relation between the total energy, the electronic potential at the nucleus and the chemical potential is derived within the context of density functional theory of atomic ions, using the homogeneity properties of the energy functional. An explicit application is then performed for two-electron ions in the context of the Hartree-Fock approximation. (10 refs.)

70768 Local spin-density description of multiple metal-metal bonding: Mo_2 and Cr_2. J.Bernholc, N.A.W.Holzwarth (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.14512-4 (9 May 1983).
Bonding and dissociation properties of multiply bonded Mo_2 and Cr_2 molecules are examined with use of the local spin-density theory and ab initio pseudopotentials. The equilibrium properties are in good agreement with experimental data. The core-polarization shifts are large; pseudopotentials give accurate results for multiply bonded systems only if outer-core *p* electrons are

included in the calculations. The results confirm the applicability of pseudopotential technqiues to these systems. (29 refs.)

70769 New spectroscopic proofs supporting the existence of a σ,π coupling between a benzenic chromophore and an α carbon atom without the need of hyperconjugative hydrogen atoms and symmetry elements. D.Denis-Courtois, B.Vidal (Univ. des Sci. et Techniques de Lille, Villeneuve d'Ascq, France).
Spectrosc. Lett. (USA), vol.16, no.4, p.267-74 (1983).
It is not essential to describe in terms of symmetry the coupling between the π_ϕ cloud and the σ skeleton of the substituent in benzyl derivatives (ϕCH_2X). Symmetry conditions are too restrictive. More precisely, spectroscopic data in the near UV range support the idea that neither a C_{3v} symmetry ($-CX_3$), nor a C_s one ($-CH_2X$ or $-CHX_2$), which previously seemed to be required from the substituent to observe that σ,π coupling, is in fact necessary. It is always possible to produce, from atomic orbitals belonging to C_α and orbitals of H and X involved in the C-H and C-X bonds, combination which have nodal surfaces allowing a coupling with the p_π orbitals. C-H bonds are not to be privileged in the treatment: all the substituents on C_α participate in the hyperconjugative process. The authors' results have been established with molecules where X is $-CO_2H$, $-CO_2^-$ or $-OH$. (10 refs.)

70770 Bond-alternating Huckel-Mobius and related, twisted linear, cyclic and helical systems—their molecular orbitals, energies and phase correlation upon dissociation. Ying-Nan Chiu (Dept. of Chem., Catholic Univ. of America, Washington, DC, USA).
Theor. Chim. Acta (Germany), vol.62, no.5, p.403-27 (1983).
Cyclic group formalism and screw symmetry operation are used to clarify and generalize the definition of Huckel and Mobius systems. It is shown that the Mobius ring system has half-integral pseudo-angular momentum similar to that of spin space, and that applications of Mobius electronics to chemical reactions have been based on truncated single-circle Mobius rings which have unique beginning and end. Definition of a Huckel versus Mobius ring system for in-plane and out-of-plane π, δ and ϕ orbitals as well as the appropriate relative angle of twists are given. Using the concept of the compatibility of the twist (screw) angle and rotation around a ring, the author also derives the proper phase coherence and energy correlation between a parent cyclic (Huckel or Mobius) molecule and its dissociated linear fragments. The concept of parentage in diabatic fragmentation is discussed. For finite, open, helical chain molecules, an exact period boundary condition based on the compatibility of twist angle and number of turns in a helical ring parent molecule is applied to derive their analytic wavefunctions. For bond-alternating 'linear' and cyclic Huckel and Mobius systems the author also derives the explicit LCAO-MO wavefunctions, energies, their degeneracies and their exact corresponding quantum members for even and odd atom systems at highest bonding and lowest antibonding levels. (42 refs.)

70771 Σ-factorization method: a new development of molecular-orbital theories based on one-centre approximation of atomic and molecular densities. A.W.Niukkanen, L.A.Gribov (Vernadsky Inst. of Geochem. & Analytical Chem., Acad. of Sci., Moscow, USSR).
Theor. Chim. Acta (Germany), vol.62, no.5, p.443-60 (1983).
A new approach to one-centre approximation methods initiated by Mulliken and Ruedenberg in their earlier works has been developed in this paper. Despite the similarity of underlying ideas, the proposal to factorize the *s*-function product instead of the total density factorization along with a new technical background of the method provide more flexible and practical scheme since large orbital quantum numbers do present no longer the crucial point for extending the approach for compounds with heavy atoms. Both minimal and extended schemes are equally within the scope of the method. The technical links with the nuclear shell model formalism are discussed briefly. (26 refs.)

Radio-frequency and laser spectroscopy studies of low-lying states in SrI .... See Entry 70802

Relativistic many-body approach to the photoionization of cesium .... See Entry 70830

Ab initio second-order Moller-Plesset calculations of the vibrational spectra of cyclobutadiene and its isotopic derivatives .... See Entry 70836

Spectroscopic investigation of the electronic structure of the chlorine molecule in the VUV .... See Entry 70897

Photoelectron spectra of 1,2,3-triazine and its methyl derivatives .... See Entry 70946

The radiative lifetime of the $A^1\Pi$ state of CH^+ calculated from long CAS SCF expansions .... See Entry 70955

Diatomics-in-molecules potential energy surfaces of $(HeH_2)^+$: an extended basis set calculation .... See Entry 70980

Rotational and vibrational-rotational relaxation in collisions of $CO_2(01^10)$ with He atoms .... See Entry 70996

Collective effects in atomic collisions. I. Constrained Hartree-Fock approach for diatomic systems .... See Entry 71009

Collective effects in atomic collisions. II. Dynamics of charge flows in diatomic collision systems .... See Entry 71010

A self-consistent field approach to atomic scattering: application to low energy positron-hydrogen scattering and annihilation .... See Entry 71012

The reaction pathway for the hydration of ketenimine by water dimer. An ab initio study .... See Entry 73317

A perturbational molecular orbital analysis of the cycloaddition of 2-carbomethoxy-1,4-benzoquinone to vinylcyclohexene .... See Entry 73318

An ab initio calculation of the dissociation $C_2H_2(^1\Sigma^+) \rightarrow C_2H(^2\Sigma^+) + H(^2S)$ .... See Entry 73332

31.20G Other accurate, or nearly ab initio calculations (DIM method, SAMO method, etc.)

70772 Electronic structure and magnetic properties of the PO_3^{2-} radical: a molecular-orbital study. J.Weber, Y.Cornioley (Lab. de Chimie Theorique Appliquee, Univ. de Geneve, Geneva, Switzerland), M.Geoffroy.
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.636-40 (29 April 1983).
Spin-polarized and non-spin-polarized molecular-orbital MS Xα calculations have been performed for the radical PO_3^{2-}. ^{31}P and ^{17}O magnetic hyperfine tensors are determined together with the spin densities in the different orbitals of these two atoms. These results are in good agreement with the experimental values. It is shown that ≈20% of the Fermi contact coupling is due to inner-shell polarization. (17 refs.)

70773 MS Xα and LCAO Xα calculations of ionization potentials. A comparison with Koopmans' theorem and accurate calculations. G.de Alti, P.Decleva, A.Lisini (Istituto di Chimica, Univ. di Trieste, Trieste, Italy).
Chem. Phys. (Netherlands), vol.76, no.2, p.185-93 (15 April 1983).
Ionization potentials of small molecules are calculated by the MS Xα and LCAO Xα methods. The results are compared with the experimental values and the results of previous accurate calculations. The Xα method proves to be rather accurate and potentially superior to the HF method. Indication is found of a possible failure of the method in the fluoromethanes. The limitation of the MS Xα method is discussed. (69 refs.)

70774 Basis set effects on spectroscopic constants for C_2 and Si_2 and the symmetry dilemma in the *Xα* model. B.I.Dunlap (Naval Res. Lab., Washington, DC, USA), W.N.Mei.
J. Chem. Phys. (USA), vol.78, no.8, p.4997-5003 (15 April 1983).
In an attempt to perform thorough and accurate linear combination of atomic orbitals (LCAO) *Xα*, calculations on $C_2$and Si_2, the effects of basis set composition on the computed spectroscopic constants are investigated for the first time. The questions of how to tell if an adequate basis set has been found and what *Xα* state corresponds to the lowest state of $^1\Sigma_g{}^+$ symmetry which involves strong electron correlation effects are addressed. With the larger bases, general agreement with experiment and previous density functional calculations are obtained. Remarkable agreement with the configuration interaction (CI) calculations of Bruna et al. (1980) on Si_2 is obtained if the fractional occupation number method of Slater et al. (1969) is used. (35 refs.)

Photoelectron spectra of the lanthanide trihalides and their interpretation .... See Entry 70949

Molecular-orbital basis for superconductivity in high- and low-dimensional metals .... See Entry 72540

31.20L Statistical model calculations (Thomas-Fermi and Thomas-Fermi-Dirac models)

70775 The calculation of diamagnetic susceptibilities from the Thomas-Fermi-Amaldi theory of atoms. M.C.Donnamaria, E.A.Castro, F.M.Fernandez (Seccion Quimica Teorica, INIFTA, La Plata, Argentina).
J. Chem. Phys. (USA), vol.78, no.8, p.5013-15 (15 April 1983).
The importance of the Fermi-Amaldi correction for the Thomas-Fermi theory of atoms is re-examined with respect to a recent work [P. Csavinsky, Int. J. Quantum Chem., vol.15, p.511 (1979)]. The calculated values of diamagnetic susceptibilities show an improvement over values determined from the Thomas-Fermi theory. (16 refs.)

70776 Is the condition for bound-state formation insensitive to structure changes in a finite cluster of like charges with self-consistent Thomas-Fermi screening?. N.H.March (Theoretical Chem. Dept., Univ. of Oxford, Oxford, England).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.223-4 (2 May 1983).
A finite cluster of N like charge Ze is considered in the self-consistent Thomas-Fermi theory. It is shown that a necessary condition for bound-state formation is $NZ > \sqrt{3}/4$, independent of structure. (6 refs.)

31.20N Semi-empirical NDO calculations (CNDO, INDO, MINDO, PCILO methods, etc.)

70777 CNDO/S calculations of resonance Raman spectra and pre-resonance excitation profiles of organic molecules. G.Marconi (Istituto FRAE-CNR, Bologna, Italy).
THEOCHEM (Netherlands), vol.10, p.289-94 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The relative enhancement of the Raman intensities in the pre-resonance region has been computed for naphthalene, using the vibronic coupling expansion proposed by Albrecht (1971). The relevant vibronic and transition moments have been computed in the CNDO/S approximation while the normal coordinates of naphthalene have been evaluated using a MINDO/3 program. The experimental pattern of intensities is reproduced in satisfactory way both for b_{3g} and a_g vibrations. The most important states and the main vibronic terms in the expansion are individuated and discussed with respect to the vibronic borrowing present in the fluorescence spectrum of naphthalene. For styrene, the nature of the low-lying singlet states has been investigated through calculation of the resonance Raman spectrum and the pre-resonance Raman profiles of the three modes of C=C stretching nature. A satisfactory agreement with the experiment is found and an analysis of the main contributions to the intensity is provided in terms of vibronic matrix elements. The possibility of destructive interference of diagonal and off-diagonal terms is analyzed for the three modes examined. (13 refs.)

70778 An MNDO study of sulfenium ions. J.L.Ginsburg (Dept. of Chem., Saint Mary's Univ., Halifax, NS, Canada), R.F.Langler.
Can. J. Chem. (Canada), vol.61, no.3, p.589-93 (March 1983).
An MNDO study has been carried out on a variety of substituted sulfenium ions and sulfides. Relative stabilities in the gas phase have been calculated for several pairs of regioisomeric sulfenium ions. Sulfenium ions are stabilized by π-donors and that the substituent electronegativity is not an important factor. The potential implications of this result for the mechanism by which chlorosulfonium cations are converted into sulfenium ions in solution is discussed. Substituent effects on the energetics of sulfenium ion formation from sulfides have been obtained. These effects also are related to the substituent's π-donating ability. A frontier-orbital analysis of selected sulfenium ions has been done and is discussed. (19 refs.)

70779 Molecular orbital study of several γ-aminobutyric acid-uptake inhibitors. S.Guha, D.Majumder (Crystallography & Molecular Biology Div., Saha Inst. of Nuclear Phys., Calcutta, India).
Indian J. Chem. B, vol.21B, no.9, p.875-7 (Sept. 1982). [received: May 1983]
CNDO/2 method has been applied to study the electronic and conformational aspects of several γ-aminobutyric acid (GABA)-uptake inhibitors, like guvacine, isoguvacine and β-aminoisobutyric acid. The minimum energy conformations of these molecules have been computed and the relevant distances in these compared with those of GABA and nipecotic acid, a powerful GABA-inhibitor. (6 refs.)

70780 Removal of anomalies in CO_2 calculations by using symmetry functions in fixed configurations. G.Blyholder, F.Ruette (Dept. of Chem., Univ. of Arkansas, Fayeteville, AR, USA), J.D.Head.
Spectrosc. Lett. (USA), vol.16, no.4, p.299-309 (1983).
Questions have been raised about level crossing, anomalous minima and discontinuities in properties for CO_2 as the molecule is bent from a linear geometry. The question of semi-empirical vs. ab initio calculations has also

been raised. The work of Van-Catledge (1974) clearly showed the source of the discontinuities to be a level crossing. Further, the use of configuration interaction eliminated the slope discontinuity for the energy of the ground state wavefunction. However in his INDO energies for specific configurations there were still discontinuities in the energy. MINDO/3 calculations for CO_2 with a fixed configuration of symmetry functions are presented which indicates that the discontinuities are readily eliminated. (9 refs.)

Electronic spectra of biphenylene and diazabiphenylenes ....See Entry 70846

Proton and carbon-13 nuclear magnetic resonance spectra and INDO study of serotonine, tryptamine and L-tryptophan ....See Entry 70914

Electrostatic solvent effect on the circular dichroism of the carbonyl $n \rightarrow \pi^*$ transition ....See Entry 70928

31.20P Other semi-empirical calculations (Hückel, generalized Hückel, PPP methods, etc.)

70781 Theoretical investigation on hydroformylation reactions. III. Hydrocarbonyliron-propylene π-intermediates. V.Bellagamba, R.Ercoli, A.Gamba (Istituto di Chimica Fisica, Univ. di Sassari, Sassari, Italy).
THEOCHEM (Netherlands), vol.10, p.333-9 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
For pt.II see J. Organometal. Chem., vol.235, p.201 (1982). The formation of possible intermediates from hydrocarbonyliron and propylene, the simplest model system of an olefin with an asymmetric double bond, was investigated. Extended Huckel calculations predict four stable isomers of the π-complex $H_2Fe(CO)_3$-propylene generated by reciprocal rotation of the component moieties. Their optimized geometries were calculated, and their stabilization curves turned out to have no barriers. The minimum energies of the conformers are strictly comparable, and their interconversion path was determined. Two of these isomers seem more apt to turn into a linear alkyl and the other ones are more favourable to a branched alkyl. (6 refs.)

70782 Explicit construction and algebraic structures of Huckel propagators and their applications. K.Nishikawa, M.Yamamoto, S.Aono (Dept. of Chem., Kanazawa Univ., Kanazawa, Japan).
J. Chem. Phys. (USA), vol.78, no.8, p.5031-42 (15 April 1983).
Propagator theory is developed in the Huckel model. Analytical expressions of Huckel propagators for linear and ring molecules with and without bond alternation are obtained by analyzing the Dyson's equation. Further, the propagators for molecules of complex topological structures are constructed in systematic ways with those for simpler linear and ring systems. By applying the partitioning technique to the Dyson's equation, it is easily shown that the propagators of complex systems are formally brought into the same form as those for the simple ones with renormalized Coulomb and resonance integrals. Finally, some physical quantities are directly evaluated by the integration method proposed by Coulson (1940). (26 refs.)

An extended Huckel study of hydrogen and oxygen chemisorption on Ru(001) surface ....See Entry 72223

31.20R Valence bond calculations (ab initio or not)

70783 Electronic interactions in heterocyclic compounds: 2-substituted benzoxazoles. J.M.Angelelli, J.C.Poite (Faculte des Sci. et Techniques de Saint-Jerome, Marseille, France).
Spectrosc. Lett. (USA), vol.16, no.3, p.193-7 (1983).
The determination of a valence-bond model for the $\nu_{C=N}$ vibration in 2-substituted benzoxazoles is possible using a quantitative method, based on integrated infrared intensities. By comparison with the parent compounds, 2-substituted benzothiazoles, the authors conclude that the electronic interactions in benzoxazoles may lead to similar correlations to those already described for benzothiazoles. (10 refs.)

Molecular orbital study of proton transfer in $(H_3NHOH_2)^+$ ....See Entry 70792

31.20T Electron correlation and CI calculations

70784 MRD-CI calculations for the low-lying electronic states of scandium hydride and titanium hydride. J.Anglada (Univ. Bonn, Bonn, Germany), P.J.Bruna, S.D.Peyerimhoff, R.J.Buenker.
THEOCHEM (Netherlands), vol.10, p.299-308 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The authors report some results of current calculations on ScH and TiH, in the hope of aiding experimentalists to understand the available measured data or to stimulate interest for future investigations in this direction, both by theoretical and experimental methods. They include results for the dissociation energies. (24 refs.)

70785 The relative stability of $^2\Sigma^+$ and $^2\Pi$ states in the systems CSi^-, Si_2^-, SiP and P_2^+ as predicted in MRD-CI calculations. P.J.Bruna, H.Dohmann, J.Anglada, V.Krumbach, S.D.Peyerimhoff (Univ. Bonn, Bonn, Germany), R.J.Buenker.
THEOCHEM (Netherlands), vol.10, p.309-18 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The ab initio MRD-CI (multi-reference single and double-excitation CI) method with configuration selection and the use of various perturbative corrections is employed for the calculation of the various electronic states of the title molecules. (35 refs.)

70786 Bond alternation in infinite polyene: Peierls distortion reduced by electron correlation. S.Suhai (Friedrich-Alexander-Univ. Erlangen-Nurnberg, Erlangen, Germany).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.619-25 (29 April 1983).
The formation of the bond-alternating structure in polyene is investigated both within the one-particle (Hartree-Fock) picture and including electron correlation effects by perturbation theory. An off-diagonal charge-density wave of the equidistant structure is identified at the Hartree-Fock level as precursor of the bond-alternate state which is found by subsequent lattice optimization. The valence-shell correlation energy is calculated by using second-order Moller-Plesset perturbation theory. It is found to be finite also in the metallic one-dimensional chain and a comparison with results obtained for the acetylene unit shows that this method recovers ≈70-75% of the total valence-shell correlation. Correlation effects are shown to reduce the Peierls distortion and the corresponding energy barrier but the bond alternation persists also if the results are extrapolated to the case of full correlation. (32 refs.)

70787 Comments on the unlinked cluster effects in limited CI calculations of electron affinities. A.Balkova (Polymer Inst., Acad. of Sci., Bratislava, Czechoslovakia).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.49-52 (6 May 1983).
The effect of unlinked clusters in limited configuration interaction calculations is studied in the calculation of electron affinities. The role of unlinked clusters is estimated through the renormalization term in fourth order of the many-body perturbation theory expansion. The size-inconsistency problem is discussed in the calculation of properties which are given as energy differences. (21 refs.)

70788 Cluster expansion of the wavefunction. Outer- and inner-valence ionization spectra of CS_2 and COS. H.Nakatsuji (Dept. of Hydrocarbon Chem., Kyoto Univ., Kyoto, Japan).
Chem. Phys. (Netherlands), vol.76, no.2, p.283-93 (15 April 1983).
The ionization spectra of CS_2 and COS are calculated by the SAC CI theory for both the outer- and the inner-valence region. The theoretical spectra compare well with the Mg Kα and He II photoelectron spectra, as well as the previous results for CO_2. In the inner-valence region, the theoretical spectra consist of a large number of peaks due to a mixing between single ionizations and simultaneous ionization-excitation (shake-up) configurations. Assignments of the observed spectra and explanations of the origins of the similarities and differences in the photoelectron spectra of CO_2, CS_2 and COS are given. The important role of four-electron excited configurations in addition to three-electron ones, which are included as unlinked terms in the SAC CI theory, is indicated. (24 refs.)

70789 Singlet cyclobutyne: a relative minimum on the C_4H_4 potential energy hypersurface?. G.Fitzgerald, P.Saxe, H.F.Schaefer,III (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.4, p.690-5 (23 Feb. 1983).
The lowest singlet and triplet electronic states of cyclobutyne have been investigated by using the nonempirical molecular electronic structure theory. Initially, singlet cyclobutyne was studied with use of two-configuration self-consistent-field (TCSCF) methods and triplet cyclobutyne with single-configuration SCF theory. Three standard basis sets, of double-ζ (DZ) through double-ζ plus polarization (DZ+P) caliber, were employed, the largest being designated C(9s5p1d/4s2p1d), H(4s1p/2s1p). Geometrical structures and harmonic vibrational frequencies were determined with use of analytic gradient techniques. Subsequently, the different stationary points were subjected to electron-correlation studies, including in a fully variational manner as many as 74625 configurations. (36 refs.)

70790 Structure and energetics of [4.4.4.4.]fenestrane. J.M.Schulman, M.L.Sabio, R.L.Disch (Dept. of Chem., City Univ. of New York, Flushing, NY, USA).
J. Am. Chem. Soc. (USA), vol.105, no.4, p.743-4 (23 Feb. 1983).
The energetics of the D_{2d} and C_{4v} forms of [4.4.4.4.]fenestrane were explored by ab initio calculation. Geometries were optimized in the STO-3G basis set and relative energies, heats of formation and strain energies were calculated at the SCF level in the 6-31G* basis set and to second order in electron correlation in the 4-31G basis set. The strain energy of the more stable D_{2d} form is found to be 160 kcal/mol. The C_{4v} form is estimated to be less stable than the D_{2d} form by 48.3 kcal/mol. (16 refs.)

70791 MCSCF/CI investigation of the low-lying potential energy surfaces of the formyloxyl radical, HCO_2. D.Feller, E.S.Huyser, W.Thatcher Bordon, E.R.Davidson (Dept. of Chem., Univ. of Washington, Seattle, WA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.6, p.1459-66 (23 March 1983).
Configuration interaction calculations have been performend on the low-lying potential energy surfaces of the formyloxyl radical. Minima and transition-state geometries were determined by an MCSCF procedure. The energies were then refined by large CI calculations. These calculations show the radical to have a σ ground state and a low-energy π excited state. On the ground-state surface, the lowest C_{2v} $^2B_2$ and $^2A_1$ energies are connected by a low-energy path passing through $^2A'$ points with unequal C-O bond lengths. This surface contacts the second $^2A'$ surface at the $^2B_2$-$^2A_1$ crossing point to form a Jahn-Teller double cone. On the lowest surface for a π radical, a C_{2v} $^2A_2$ energy is found to be a minimum, but there is very little energy change of large-amplitude asymmetric stretching. The transition states for fragmentation of HCO_2. to H.+CO_2 and for rearrangement to .CO_2H have also been determined. (20 refs.)

70792 Molecular orbital study of proton transfer in $(H_3NHOH_2)^+$. S.Scheiner (Dept. of Chem. & Biochem., Southern Illinois Univ., Carbondale, IL, USA), L.B.Harding.
J. Phys. Chem. (USA), vol.87, no.7, p.1145-53 (31 March 1983).
Ab initio molecular orbital methods are used to study transfer of the central proton in the asymmetric $(H_3NHOH_2)^+$ system. Calculations are performed at the Hartree-Fock level with basis sets of split-valence (4-31G) and double-ζ plus polarization function (DZP) quality. The effects of electron correlation upon the transfer potentials are computed via the generalized valence bond (GVB) and polarization configuration interaction (POL-CI) techniques. The barrier to proton transfer between NH_3 and OH_2 heightens as the distance between the latter two molecules is increased. At the equilibrium R(NO) hydrogen-bond length, the transfer potential contains a single minimum, $(H_3NH...OH_2)^+$, in which the central proton is more closely associated with NH_3. In both the rapid and adiabatic models of proton transfer, there is no energy barrier to decay of $(H_3N...HOH_2)^+$ to the equilibrium $(H_3NH...OH_2)^+$ structure. While all the calculations agree on the above points, there are some notable quantitative discrepancies between the various methods. Enlargement of the basis set at the Hartree-Fock level results in higher transfer barriers with subsequent inclusion of electron correlation (POL-CI) leads to barrier reductions. The GVB procedure, with its partial treatment of correlation, produces changes in the potentials opposite to those observed for the more complete POL-CI treatment. (43 refs.)

70793 Applicability of a pseudopotential CI method to the investigation of ground and excited states of molecular systems: NaCO, Li_2H, Al_2 and AlH. G.Pacchioni (Inst. fur Phys. Chem., Freie Univ. Berlin, Berlin, Germany).
Theor. Chim. Acta (Germany), vol.62, no.5, p.461-75 (1983).
The potential energy curves for the ground and first excited states of some molecules involved in very different problems of theoretical chemistry have been determined employing the pseudopotential (PP) SCF procedure followed by multireference double-excitation configuration interaction treatment (MRD CI). The influence of the choice of the basis set is widely discussed. The PP results are overall in excellent agreement with the results obtained from the analogous all electron (AE) calculations when sufficiently flexible basis sets are adopted. Some small discrepancies encountered are due to the use of minimal basis sets. (36 refs.)

A model of the electronic configuration of atoms, and a mathematical formulation for the periodic system of elements ....See Entry 70757

Perturbation of the Ba 6sng series at n=24 by zero-field spectroscopy and forced autoionization ....See Entry 70827

Inner-shell photoionisation in molecules: the carbon monoxide case .... See Entry 70829

Electronic spectra of biphenylene and diazabiphenylenes .... See Entry 70846

Electrostatic solvent effect on the circular dichroism of the carbonyl $n \rightarrow \pi^*$ transition .... See Entry 70928

Oscillator strengths and collision strengths for S II .... See Entry 71016

Structure and stability of Li_4 and Li_6 clusters .... See Entry 71045

Study of correlation effects in the calculation of heats of reactions .... See Entry 73357

31.30 CORRECTIONS TO ELECTRONIC STRUCTURE

70794 **Energy levels of francium.** V.A.Dzuba, V.V.Flambaum, O.P.Sushkov (Inst. of Nuclear Phys., Novosibirsk, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.230-2 (2 May 1983).
Many-body perturbation theory is used for relativistic calculations of energy levels and of fine-structure intervals for 20 lower states of francium. The zeroth-order approximation is obtained by the relativistic Hartree-Fock method. The second-order correlation corrections are calculated. The accuracy for the s, p and f energy levels is not worse than 0.5%. (6 refs.)

Local spin-density description of multiple metal-metal bonding: Mo_2 and Cr_2 .... See Entry 70768

Is the condition for bound-state formation insensitive to structure changes in a finite cluster of like charges with self-consistent Thomas-Fermi screening? .... See Entry 70776

Radio-frequency and laser spectroscopy studies of low-lying states in SrI .... See Entry 70802

Zeeman effect at the hydrogen atom in the new Dirac field theory .... See Entry 70811

Stark effect at the hydrogen atom in the new Dirac field theory .... See Entry 70812

Relativistic many-body approach to the photoionization of cesium .... See Entry 70830

IR-spectroscopic study of isotope effects on the MH/ND-stretching bands of meso-tetraphenylporphine and vibrational hydrogen tunneling .. See Entry 70861

Jahn-Teller effect and resonance Raman spectra of highly spin-degenerate molecules with application to $FeBr_4^-$ .... See Entry 70882

Photodissociation kinematics. II. Laboratory angular distributions of a hydride model system and the kinematic isotope effect .... See Entry 70968

Elastic scattering of slow electrons from Ar and Kr atoms ..... See Entry 71014

31.50 EXCITED STATES

70795 **Triplet 4*d* states of H_2: experimental observation and comparison with an ab initio model for Rydberg-state energies.** E.E.Eyler, F.M.Pipkin (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA).
Phys. Rev. A (USA), vol.27, no.5, p.a2462-78 (May 1983).
The triplet 4*d* states of H_2 have been studied by using a tunable single-mode dye laser to excite metastable molecules in the $2p\ ^3\Pi_u$ state to the 4*s* and 4*d* triplet states. Ninety-three transitions were detected and their line positions measured. Some of these states decay primarily to predissociation. A simple model for the energies of the Rydberg states was developed; the model depends upon the polarizability and quadrupole interactions of the Rydberg electron with the H_2^+ core. It provides a remarkably good description of the measured energy intervals. (29 refs.)

70796 **Comparisons of approximate bases for hydrogen in a magnetic field.** M.L.Zimmerman, R.G.Hulet, D.Kleppner (Dept. of Phys., MIT, Cambridge, MA, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2731-4 (May 1983).
Solutions to the diamagnetic Hamiltonian for Rydberg states of hydrogen are studied in the low-magnetic-field regime where term mixing can be ignored. Several recently proposed approximate bases are compared by calculating the overlap integrals with an accurate numerically generated basis. (12 refs.)

70797 **High resolution laser spectroscopy of low-lying *p*-states in Sr I and Ba I.** E.R.Eliel, W.Hogervorst (Natuurkundig Lab., Vrije Univ., Amsterdam, Netherlands), T.Olsson, L.R.Pendrill.
Z. Phys. A (Germany), vol.311, no.1-2, p.1-6 (1983).
Hyperfine structure and isotope shifts of the second excited *P* states of SrI and Ba I have been measured. In addition, the Sr I first resonance line has been studied. The present results are combined with existing data on both high-lying and lower-lying excited states, in a simple parametric study of the level isotopic shifts in Sr I. (22 refs.)

Merits and limitations of submillimeter wavelength frequency standards based on an Mg(Ca) metastable beam .... See Entry 70035

A new heart for Rb frequency standards?: the evacuated, wall-coated sealed cell .... See Entry 70036

Singlet cyclobutyne: a relative minimum on the C_4H_4 potential energy hypersurface? .... See Entry 70789

Transitions between excited energy levels of Zr VII .... See Entry 70805

Laser studies of electronic energy transfer in atomic copper ... See Entry 70807

Absorption and emission line profile coefficients of multilevel atoms. II. Velocity-averaged profile coefficients .... See Entry 70819

Lifetime measurements in the case of weak luminescence intensities .... See Entry 70822

Radiative lifetimes of some excited levels in Eu II .... See Entry 70823

Fluorescence excitation of CO in comets .... See Entry 70848

Spectroscopy of naphthalene in simple molecular liquids .... See Entry 70892

Triplet emission from furil in different crystalline environments: optical and ODMR studies .... See Entry 70923

Delayed fluorescence $S_2 \rightarrow S_0$ from 4,6,8-trimethylazulene due to homo-triplet-triplet annihilation .... See Entry 70933

Excited-state dynamics of 3-hydroxyflavone .... See Entry 70939

Weak Van der Waals complexes of the X...BC type: calculation of linewidths of metastable levels .... See Entry 70966

Bound-free spectroscopy of Cs_2^+ .... See Entry 70972

Impact parameter dependence of *L*- and *K*-shell excitation in I-Ag collisions .... See Entry 71000

***n*-changing collisions in intermediate Rydberg states of Li induced by collisions with ground-state parent atoms** .... See Entry 71003

Alignment and orientation of charge exchange excitation with polarized projectiles .... See Entry 71011

Oscillator strengths and collision strengths for S II .... See Entry 71016

Measurement of Ne $2p^5\ 3p$ lifetimes by laser-electron-impact double excitation employing the delayed-coincidence method .... See Entry 71020

Orientation dependence in the reaction of Xe* with photodissociation polarized IBr .... See Entry 73327

Time-resolved resonance fluorescence studies of $O(^1D_2)$ yields in the photodissociation of O_3 at 248 and 308 nm .... See Entry 73356

31.70 EFFECTS OF MOLECULAR INTERACTIONS ON ELECTRONIC STRUCTURE

(see also 34. Atomic and molecular collision processes and interactions)

31.70D Environmental and solvent effects

Calculations of medium effects on absorption and emission spectra by SCRF theory .... See Entry 70760

The solvent and field dependence of ^{59}Co NMR linewidths ...... See Entry 70905

Electrostatic solvent effect on the circular dichroism of the carbonyl $n \rightarrow \pi^*$ transition .... See Entry 70928

31.70F Potential-energy surfaces for collisions

(see also 82.20K in chemical kinetics, 34.20 Intermolecular forces, 34.50L in beam studies)

70798 **Local normal modes and vibrational adiabatic potentials.** N.Agmon (Dept. of Chem., California Inst. of Technol., Pasadena, CA, USA).
Chem. Phys. (Netherlands), vol.76, no.2, p.203-18 (15 April 1983).
Local normal-mode analysis for a collinear potential energy surface generates a system of curvilinear coordinates, which are orthogonal in the mass-skewed system. The motion is locally separable in these coordinates. The author compares the utility of one of the normal modes as a transversal-vibration coordinate, with the conventional choice of the direction perpendicular to the reaction coordinate in the mass-skewed system. The comparison is done for two commonly used reaction coordinates: BEBO and the steepest-descent path. Results differ for different choices of directions and reaction coordinates. Future work should concentrate on a choice of a reaction coordinate which is itself one of the normal modes. (38 refs.)

Applicability of a pseudopotential CI method to the investigation of ground and excited states of molecular systems: NaCO, Li_2H, Al_2 and AlH .... See Entry 70793

Microwave spectral study of cyclopentyl acetylene .... See Entry 70853

High-resolution photofragment spectroscopy of the $O_2^+\ b^4\Sigma_g^-(v'=5\text{-}8) \leftarrow a^4\Pi_u(v''=6\text{-}9)$ first negative system .... See Entry 70865

Infrared emission spectrum and potential constants of HCl ..... See Entry 70868

Dunham coefficients for seven isotopic species of CO .... See Entry 70983

Rotational and vibrational-rotational relaxation in collisions of $CO_2(01^10)$ with He atoms .... See Entry 70996

A theoretical analysis of very low energy collision induced vibrational relaxation in the system $He\text{-}I_2(^3\Pi_{0u}^+)$ .... See Entry 70998

Collective effects in atomic collisions. I. Constrained Hartree-Fock approach for diatomic systems .... See Entry 71009

Collective effects in atomic collisions. II. Dynamics of charge flows in diatomic collision systems .... See Entry 71010

31.70H Time-dependent phenomena: excitation and relaxation processes, and reaction rates

(see also 34. Atomic and molecular collisions)

Excimer laser photolysis studies of translational-to-vibrational energy transfer in collisions of H and D atoms with CO .... See Entry 70995

31.90 OTHER TOPICS IN THE THEORY OF ATOMS AND MOLECULES

(inc. properties other than energy)

70799 **Scaled diatomics-in-molecules (SDIM) theory. I. General theory and preliminary applications to H_3 and H_4.** F.O.Ellison (Dept. of Chem., Univ. of Pittsburgh, Pittsburgh, PA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5024-30 (15 April 1983).
Diatomics-in-molecules (DIM) is an established semiempirical theory for calculating atomization energies and potential energy surfaces for polyatomic systems in ground and excited states. A fundamental deficiency of this method must be considered its omission of optimum scaling of the diatomic and polyatomic wave functions. A new scaled DIM (SDIM) theory is proposed which utilizes a basis of scaled exact atomic state eigenfunctions. Scaled atoms-in-molecules (SAIM) theory [Theor. Chim. Acta, vol.51, p.241 (1979)] is employed to generate approximate optimumly scaled diatomic fragment eigenfunctions. Rigorous theory is formulated for independent variational scaling of polyatomic state functions using established DIM algorithms. Polyatomic eigenvalue equations are solved in terms of diatomic and monatomic eigenvector and empirical eigenvalue input; no complex electronic integral computations are required, except for overlap (as in ordinary DIM theory) and kinetic energy integrals. Initial applications to H_3 and H_4 using a minimal basis set are reported. (31 refs.)

Singlet cyclobutyne: a relative minimum on the C_4H_4 potential energy hypersurface? .... See Entry 70789

MCSCF/CI investigation of the low-lying potential energy surfaces of the formyloxyl radical, HCO_2 .... See Entry 70791

32.00 ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

32.20 ATOMIC SPECTRA GROUPED BY WAVELENGTH RANGES

70800 Crystal-split electronic states of an atom in a rare gas crystal. Calculation of the absorption and fluorescence spectra of trapped oxygen (^3P, ^1D, ^1S) atoms. D.Maillard, J.Fournier, H.H.Mohammed (Lab. de Spectrochimie Moleculaire, Univ. Pierre et Marie Curie, Paris, France), C.Girardet.
J. Chem. Phys. (USA), vol.78, no.9, p.5480-92 (1 May 1983).
A method is proposed to determine the (crystal perturbed) energy levels of a guest species at any point inside the trapping site of an inclusion distorted host crystal. It relies on available pair potential energy curves, usually deduced from ab initio data supplemented by long-range dispersion energy when necessary. It is applied here to oxygen in its atomlike ^3P, ^1D or ^1S state imbedded in Ne, Ar, Kr, and Xe Matrix and allows reproduction of transition energies within 0.03 eV, and other experimental features. Its broad field of application could find many other exploitations, some of which are proposed. (36 refs.)

70801 Non-monotonic variation of the quantum defect in Cs nD$_J$ term series. C.-J.Lorenzen, K.Niemax (Inst. fur Experimentalphys., Univ. Kiel, Kiel, Germany).
Z. Phys. A (Germany), vol.311, no.3, p.249-50 (1983).
The nS and nD$_J$ levels of Cs have been measured with a thermionic diode applying Doppler-free two-photon spectroscopy and a vacuum wavemeter. The ionisation energy of Cs was derived to high precision from Rydberg-Ritz fitting procedure. The quantum defects of the nD$_J$ series have a surprising, non-monotonic dependence on n. (9 refs.)

Comment on the note of C.B. Shaw, Jr. on the statistical inference of four ArII transition probabilities .... See Entry 70817

32.20B Radiofrequency, microwave, and infrared spectra

(inc. magnetic resonance spectra)

70802 Radio-frequency and laser spectroscopy studies of low-lying states in SrI. P.Grundevik, M.Gustavsson, I.Lindgren, G.Olsson, T.Olsson, A.Rosen (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Z. Phys. A (Germany), vol.311, no.3, p.143-9 (1983).
Precision hyperfine structure (HFS) measurements in the $5s4d\ ^1D_2$ metastable state of ^{87}Sr were performed using the laser radio-frequency double resonance method. The magnetic dipole and electric quadrupole interaction constants were $a=-5.5734(4)$ MHz and $b=55.421(6)$ MHz. In addition high-resolution laser spectroscopy experiments were performed in the $5s4d^1D_2\rightleftharpoons 5s6p^1P_1$ and $5s4d^1D_2\rightleftharpoons 5p4d^1D_2$ transitions in SrI. The isotope shifts in the transitions and the HFS in the upper states were determined. Comparison of the experimental results with corresponding relativistic self-consistent-field (SCF) calculations shows that the states involved are very strongly perturbed. Therefore no reliable nuclear quadrupole moment for ^{87}Sr can be deduced from the data without more detailed calculations. A relativistic SCF calculation of the electron density at the nucleus was used in combination with muonic values of the nuclear mean square radii to evaluate the field shifts. From the experimental isotope shifts the specific mass shifts in the two transitions can then be deduced. This shift was found to be particularly large in the transition $5s4d^1D_2\rightleftharpoons 5s6p^1P_1$. (22 refs.)

70803 Hyperfine structure of low-lying even levels of ^{161,163}Dy and ^{167}Er by atomic-beam laser-RF double resonance. W.J.Childs, L.S.Goodman, V.Pfeufer (Argonne Nat. Lab., Argonne, IL, USA).
Z. Phys. A (Germany), vol.311, no.3, p.251-2 (1983).
Radiofrequency measurements of the zero-field hyperfine intervals in low levels of ^{167}Er and ^{161,163}Dy have been made as part of a systematic study of the second half of the $4f^N6s^2$ configuration of the neutral rare-earth atoms. Almost no precise HFS data exist for this region, and a preliminary analysis indicates systematic differences between ab initio theory and experiment. (17 refs.)

Vibrational intensities in infrared and Raman spectroscopy ..... See Entry 69802

Precision isotope shifts for the heavy elements. II. Neutral thorium .... See Entry 70816

Orientation of ^{4}He (2^3S_1) atoms in collisions with optically oriented Cs atoms .... See Entry 71001

Precise determination of the ground state hyperfine splitting of ^{135}Ba$^+$ .... See Entry 71032

32.20J Visible and ultraviolet spectra

(for fluorescence and phosphorescence spectra, see 32.50)

70804 Absorption spectrum of atomic bromine (Br I) in the vacuum ultraviolet region. V.N.Sarma, Y.N.Joshi (Phys. Dept., St. Francis Xavier Univ., Antigonish, Nova Scotia, Canada).
J. Phys. B (GB), vol.16, no.10, p.1671-83 (28 May 1983).
The absorption spectrum of bromine was photographed in the region 900-1700 Å on a three-metre normal-incidence spectrograph. The absorption cell consisted of a flash pyrolysis system and the background continuum source was a Garston flash lamp. The Rydberg series converging on $4p^4\ ^3P_2$, $^3P_1$, $^3P_0$ and $^1D_2$ have been greatly extended. One hundred and fourteen additional lines have been classified, more than doubling the number of the classified lines in this region. (16 refs.)

70805 Transitions between excited energy levels of Zr VII. Z.A.Khan, M.S.Z.Chaghtai, K.Rahimullah (Phys. Dept., Muslim Univ., Aligarh, India).
J. Phys. B (GB), vol.16, no.10, p.1685-93 (28 May 1983).
Based on the spectrograms recorded at Lund University, 249 newly classified lines of six times ionised zirconium atoms (Zr VII) are reported. All the 38 energy levels of the $4p^34d$ configuration along with 24 of the $4p^35p$ and 39 of the $4p^34f$ configurations are now established through the transitions $4p^4$-$4p^34d$, $4p^3$(4d-4f, 5p) and $4p^3$(5s-5p) which lie in the wavelength region 290-2500 Å. (7 refs.)

High resolution laser spectroscopy of low-lying *p*-states in Sr I and Ba I .... See Entry 70797

Precision isotope shifts for the heavy elements. II. Neutral thorium .... See Entry 70816

Oscillator strengths of neutral and singly ionised molybdenum .... See Entry 70820

Improved Ar(II) transition probabilities .... See Entry 70821

Perturbation of the Ba 6sng series at $n=24$ by zero-field spectroscopy and forced autoionization .... See Entry 70827

Oscillator strengths and collision strengths for S II .... See Entry 71016

32.20R X-ray spectra

70806 Dependence of X-ray energy on number of optical electrons in ions. N.A.Kulagin (Khar'kov State Univ., Khar'kov, Ukrainian SSR).
J. Phys. B (GB), vol.16, no.10, p.1695-702 (28 May 1983).
The paper is devoted to obtaining the dependence of the characteristic X-ray radiation energy of ions on the number of electrons of the nl^N configuration. The common dependence is a fourth degree polynomial in N. Numerical results are derived for the Cr ion. Through a comparison of the theoretical expression with experimental data the electronic states of the Sn ion are determined in various crystals. The X-ray energy values for 3d and 4f ions are deduced. (15 refs.)

Investigation of K X-rays which accompany the decay of $^{168}\mathrm{Tm}\rightarrow{}^{168}\mathrm{Er}$ .... See Entry 70502

Deexcitation rates and fluorescence yields of highly stripped atoms .... See Entry 70809

Analysis of the $4d^9$-$4d^85P$ transitions in nine-times ionized zenon (Xe X) .... See Entry 70815

Elastic and inelastic scattering of high-energy electrons and X-rays by NH_3, CH_4 and H_2O molecules .... See Entry 71015

Plasma shifts of the Lyman lines to shorter wavelengths in C VI .... See Entry 71705

High-resolution X-ray spectra from molybdenum ions in the Alcator-*C* Tokamak .... See Entry 71706

32.50 FLUORESCENCE, PHOSPHORESCENCE

(inc. quenching)

70807 Laser studies of electronic energy transfer in atomic copper. Hao-Lin Chen, G.Erbert (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4985-90 (15 April 1983).
Laser-induced fluorescence and crossed-beam optical pumping and probing techniques were used to study the cross sections of collisional mixing deactivation of electronically excited copper atoms ($^2P_{3/2}$, $^2P_{1/2}$, $^2D_{3/2}$, and $^2D_{5/2}$) in various buffer gases. The cross sections for total deactivation of metastable status ($^2D_{5/2}$, and $^2D_{3/2}$) to the ground state by the collision partners He, Ne, Ar, H_2, D_2 and N_2 at 1450°C are less than 10^{-20} cm^2. Cross sections for the collisional mixing of $^2D_{5/2}$ and $^2D_{3/2}$ levels are more than an order of magnitude larger. However, collisional mixing of the $^2P_{3/2}$ and $^2P_{1/2}$ levels by the buffer gases does take place more rapidly with cross sections in the range of 10^{-16} cm^2. The cross sections for total deactivation of Cu($^2D_{5/3}$) to ground state, collisional mixing of the $^2P_{3/2,1/2}$ levels, and collisional mixing of the $^2D_{5/2,3/2}$ levels by atomic Cu at 1450°C are 4.8×10^{-17}, 8.7×10^{-15}, and 1.7×10^{-15} cm^2, respectively. (10 refs.)

70808 Thermal reservoir effects in resonance fluorescence. G.P.Hildred (Dept. of Math., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England), S.S.Hassan, R.R.Puri, R.K.Bullough.
J. Phys. B (GB), vol.16, no.10, p.1703-19 (28 May 1983).
The authors investigate the resonance fluorescence of a single coherently driven atom in the presence of an additional incoherent field. The analysis is based on a master equation describing the driven atom coupled to a reservoir and the incoherent field may be the black-body field associated with the finite temperature of the reservoir. The incoherent field induces asymmetries in the usual three-peaked Stark spectrum and these are compared with asymmetries derived from other models—notably the 'laser diffusion' model, and a more fundamental analysis. The theory is extended to the case of two or more atoms; the additional side bands (dips) in the fluorescence (absorption) spectrum occurring at higher harmonics of the laser Rabi frequency are also affected by the thermal field. (32 refs.)

70809 Deexcitation rates and fluorescence yields of highly stripped atoms. E.Arndt, E.Hartmann (Zentralinst. fur Isotopen- und Strahlenforschung, Akad. der Wissenschaften, Leipzig, Germany).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.146-7 (25 April 1983).
Relativistic calculations of X-ray transition rates, Auger transition rates and fluorescence yields have been performed for highly stripped atomic lead ions. The fluorescence yield is nearly unaffected by the removal of outer-shell electrons and can be calculated from statistical scaling using the transition matrix elements of an atom with one inner-shell vacancy. (5 refs.)

70810 Distribution of photons and atomic momentum in resonance fluorescence. S.Stenholm (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2513-22 (May 1983).
Discusses the connection betwee the atomic-momentum distribution due to photon recoil and photon statistics. A new formulation is presented based on a Fourier transform with respect to momentum. The asymptotic approximation that is equivalent to a Fokker-Planck treatment is found. Resonance fluorescence is treated in detail. The anomalous diffusion contribution recently found by Ashkin, Gordon, and Cook is separated, and its physical significance is discussed. In particular, it is pointed out that it signifies the coherence between successive photon recoil events. It follows that to obtain the correct diffusion expression one must perform the adiabatic elimination of internal atomic degrees of freedom in the frame moving with the atom, including the deflection caused by light-pressure force. Connections to earlier work are discussed. (24 refs.)

Crystal-split electronic states of an atom in a rare gas crystal. Calculation of the absorption and fluorescence spectra of trapped oxygen (^3P, ^1D, ^1S) atoms .... See Entry 70800

Absorption and emission line profile coefficients of multilevel atoms. I. Atomic profile coefficients .... See Entry 70818

Lifetime measurements in the case of weak luminescence intensities .... See Entry 70822

***n*-changing collisions in intermediate Rydberg states of Li induced by collisions with ground-state parent atoms** .... See Entry 71003

Measurement of Ne $2p^5\ 3p$ lifetimes by laser-electron-impact double excitation employing the delayed-coincidence method .... See Entry 71020

Measurement of fine and hyperfine structures and isotope shift in 2^2P-2^2S transitions of lithium by laser induced fluorescence of atomic beams .... See Entry 71031

The effect of oxygen on the sputtering of metastable atoms and ions from Ba metal .... See Entry 72929

Time-resolved resonance fluorescence studies of O($^1D_2$) yields in the photodissociation of O$_3$ at 248 and 308 nm .... See Entry 73356

32.60 ZEEMAN AND STARK EFFECTS

70811 Zeeman effect at the hydrogen atom in the new Dirac field theory. J.Brana, K.Ljolje, S.Vobornik (Dept. of Phys., Univ. of Sarajevo, Sarajevo, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.1, p.63-74 (Jan.-March 1983).
The weak constant magnetic field effect at the hydrogen atom is considered in the new Dirac field theory. The difference from the conventional theory is found beginning with the Z^2a^2 term. (8 refs.)

70812 Stark effect at the hydrogen atom in the new Dirac field theory. J.Brana, K.Ljolje (Dept. of Phys., Univ. of Sarajevo, Sarajevo, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.1, p.75-81 (Jan.-March 1983).
The weak constant electric field effect at the hydrogen atom is considered in the new Dirac field theory. The difference from the standard theory is found. They begin with the Z^2a^2 term. (7 refs.)

70813 Variation of tensor polarisability in the interacting 5s*n*d ^{1}D$_2$ Sr Rydberg series. G.Gessert, P.Kulina, R.-H.Rinkleff (Inst. fur Atom- und Molekulphys., Abteilung Spektroskopie, Univ. Hannover, Hannover, Germany).
J. Phys. B (GB), vol.16, no.10, p.L313-16 (28 May 1983).
Stark splittings of 5s*n*d ^{1}D$_2$ Sr Rydberg states were measured between $n=11$ and 20 by quantum beat spectroscopy at very low electric field strengths, allowing the determination of tensor polarisabilities. The irregular behaviour of these polarisabilities was confirmed by Coulomb approximation calculations and explained by a simple quantum defect analysis. (4 refs.)

70814 Precision measurement of the Stark shift of the 6*S*-7*S* transition in atomic cesium. R.N.Watts, S.L.Gilbert, C.E.Wieman (Randall Phys. Lab., Univ. of Michigan, Ann Arbor, MI, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2769-72 (May 1983).
The authors measured the Stark shift of the 6*S*-7*S* transition in a beam of atomic cesium with the use of laser spectroscopy. They find this shift to be 0.7103(24) Hz (V/cm)$^{-2}$. From this value the authors determine the static polarizability of the 7*S* state, $\alpha_{7\mathrm{S}}=[6111(21)]a_0^3$, and the 7*P*-7*S* oscillator strength, $f_{7\mathrm{P},7\mathrm{S}}=1.540(7)$. Finally, they derive a new empirical value for the 6*S*-7*S* Stark-induced electric dipole transition probability. (16 refs.)

Observation of Stark-shifts of Lyman-α lines of low-*Z* ions in laser-produced plasmas .... See Entry 71762

32.70 SPECTRAL LINE SHAPES AND INTENSITIES

70815 Analysis of the 4d^9-4d^{8}5P transitions in nine-times ionized zenon (Xe X). V.Kaufman, J.Sugar, J.L.Tech (NBS, Washington, DC, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.691-3 (May 1983).
The 4d^9-4d^{8}5p transition array of nine-times ionized xenon at 130-160 Å was photographically observed with the National Bureau of Standards 10.7-m grazing-incidence vacuum spectrograph. The spectral source was a high-voltage spark between carbon electrodes triggered by insertion of a small quantity of xenon. Forty-seven lines were classified as transitions from 34 levels of the $4d^85p$ configuration to the two levels of the $4d^9\ ^2D$ ground term. An excellent correlation was found between the observed and calculated relative intensities. Least-squares-fitted parameter values and their ratios to the Hartree-Fock values are given. (9 refs.)

70816 Precision isotope shifts for the heavy elements. II. Neutral thorium. R.Engelman,Jr., B.A.Palmer (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.694-701 (May 1983).
For pt.I see ibid., vol.70, p.308 (1980). High-resolution spectra of a $^{232}\mathrm{ThI}_4/^{230}\mathrm{ThI}_4$ electrodeless discharge lamp were obtained from 5600 to 36000 cm^{-1} with a Fourier-transform spectrometer. The splittings of more than 2800 Th I isotopic doublets were measured to an accuracy of 0.001 cm^{-1}. Level isotope shifts were determined for 274 even and 318 odd levels of Th I. (15 refs.)

70817 Comment on the note of C.B. Shaw, Jr. on the statistical inference of four ArII transition probabilities. K.-P.Nick, V.Helbig (Inst. fur Experimentalphys., Univ. of Kiel, Kiel, Germany).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.465-7 (May 1983).
Absolute transition probabilities are given for four ArII lines investigated by Shaw (see ibid., vol.24, p.259, 1980). Shaw used regression analysis on a large number of intensity measurements of four ArII lines with different upper-level excitation energies to correct transition probabilities of Schnapauff (1968). Shaw's data were obtained from photographic measurements with a flow-stabilized Ar arc. The authors find that the results obtained by Shaw are in error by as much as his applied correction on a relative scale. It is likely that Shaw made systematic errors. The absolute scale of Shaw's corrected values is off by about 50%. (14 refs.)

70818 Absorption and emission line profile coefficients of multilevel atoms. I. Atomic profile coefficients. I.Hubeny (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia), J.Oxenius, E.Simonneau.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.477-93 (June 1983).
The line profile coefficients for absorption and emission appearing in the radiative transfer equation are formulated in terms of atomic line profile coefficients and velocity distribution functions. In order to derive the atomic profile coefficients of a multilevel atom, one defines generalized atomic redistribution functions that describe the correlations between photons involved in a consecutive radiative transitions of the atom. Besides their dependence on the radiation field, the atomic line profile coefficients of a multilevel atom depend on the velocity distributions of the atoms in the various excitation states, in contrast to the case of a two-level atom where only the radiation intensity but not the velocity distributions affect the atomic emission profile. Closed expressions of the atomic profile coefficients in terms of generalized redistribution functions are obtained if stimulated emissions are neglected, and one is led to an iterative approximation scheme if stimulated emissions are taken into account. The possibility of a nonlocal character of the atomic profile coefficients is pointed out, and the effect of elastic, velocity-changing collisions with excited atoms is discussed. A major aim of the paper is to draw attention to the fact that ordinary redistribution functions that describe only the correlations between the absorbed and reemitted photons in the same spectral line are not sufficient to formulate the line profile coefficients of a multilevel atom. (8 refs.)

70819 Absorption and emission line profile coefficients of multilevel atoms. II. Velocity-averaged profile coefficients. I.Hubeny (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia), J.Oxenius, E.Simonneau.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.495-506 (June 1983).
For pt.I see ibid., vol.29, no.6, p.477 (1983). Starting from the atomic profile coefficients of a multilevel atom derived in the previous first part of this paper, the authors consider the velocity-averaged line profile coefficients appearing in the radiative transfer equation for the important special case that the velocity distribution of atoms in the ground state is Maxwellian and that the streaming of excited atoms is negligible. Elastic velocity-changing collisions of excited atoms with other particles are taken into account in the framework of a strong-collision model. Neglecting stimulated emissions, they obtain explicit, albeit in some cases approximate, expressions for the line profile coefficients of a three-level atom in terms of the specific radiation intensity locally present. The emission and absorption profile coefficients are written in a form that exhibits the various physical effects responsible for deviations of these profiles from complete redistribution. The case of two-level atoms in the presence of elastic collisions with the excited atoms is also treated. (9 refs.)

70820 Oscillator strengths of neutral and singly ionised molybdenum. S.E.Schnehage, K.Danzmann, R.Kunnemeyer, M.Kock (Inst. fur Plasmaphys., Univ. Hannover, Hannover, Germany).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.507-16 (June 1983).
Oscillator strengths of 174 Mo(I) and 58 Mo(II) lines in the range 2470-5570 Å were obtained from wall-stabilised arc and hollow cathode measurements. Sets of relative *f*-values were determined by a combination of hook and emission measurements requiring no assumptions concerning the plasma state. The sets have been enlarged considerably by evaluating spectra recorded with a Fourier spectrometer. The relative Mo(I) *f*-values were converted to an absolute scale by means of radiative lifetimes measured by P. Zimmermann and his group. The overall uncertainties are within 10-35%. Since lifetimes of Mo(II) levels are not yet available, only relative Mo(II) *f*-values are presented. (20 refs.)

70821 Improved Ar(II) transition probabilities. K.Danzmann, M.Kock (Inst. fur Plasmaphys., Univ. Hannover, Hannover, Germany).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.517-20 (June 1983).
Precise Ar(II) branching ratios have been measured on a high current hollow cathode with a 1-m Fourier transform spectrometer. Absolute transition probabilities for 11 Ar(II) lines were calculated from these branching ratios and lifetime measurements published by Mohamed et al. (1976). For the prominent 4806 Å line, the present result is $A_{\mathrm{ik}}=7.12\times10^7\ \mathrm{s}^{-1}\pm2.8\%$, which is in excellent agreement with recent literature data derived from pure argon diagnostics, two-wavelength-interferometry, and H$_\beta$-diagnostics when using the theoretical data of Vidal et al. (1973). (25 refs.)

70822 Lifetime measurements in the case of weak luminescence intensities. E.Geneux (Inst. de Phys. Appliquee, Univ. de Berne, Berne, Switzerland).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.85-8 (18 April 1983). In French.
A simple method concerning the possibility of lifetime's measurement in the case of low light level 20 photons/s, is described. Application to some n^1S$_0$ and ^{1}D$_2$ excited states of the Hg atom is given. (4 refs.)

70823 Radiative lifetimes of some excited levels in Eu II. A.Arnesen, R.Hallin, C.Nording, O.Staaf, O.Vogel, L.Ward (Inst. of Phys., Univ. of Uppsala, Uppsala, Sweden).
Z. Phys. A (Germany), vol.310, no.4, p.251-3 (1983).
Radiative lifetimes of the six levels $6p_{3/2}(7/2,3/2)_{2,3,4,5}$ and $6p_{1/2}(7/2,1/2)_{3,4}$ in Eu II are measured with a laser-ion beam technique using intracavity excitation and tandem pumping. (8 refs.)

Introduction to atomic and molecular collisions .... See Entry 69801

High resolution laser spectroscopy of low-lying *p*-states in Sr I and Ba I .... See Entry 70797

Precision measurement of the Stark shift of the 6*S*-7*S* transition in atomic cesium .... See Entry 70814

The *KLL* Auger spectrum of manganese .... See Entry 70833

Oscillator strengths and collision strengths for S II .... See Entry 71016

Measurement of Ne $2p^5$ 3*p* lifetimes by laser-electron-impact double excitation employing the delayed-coincidence method .... See Entry 71020

Measurement of fine and hyperfine structures and isotope shift in 2^2P-2^2S transitions of lithium by laser induced fluorescence of atomic beams .... See Entry 71031

Theory of saturated line shapes in phase-conjugate emission by resonant degenerate four-wave mixing in Doppler-broadened three-level systems .... See Entry 71201

A relation between Holstein's photon escape transmission factor and the equivalent width .... See Entry 71687

Shifts of ionized-helium lines from electron collisions in dense plasmas .... See Entry 71688

Plasma shifts of the Lyman lines to shorter wavelengths in C VI .... See Entry 71705

Evidence of anomalous multiplet line shapes in optically thick, laser-produced plasmas .... See Entry 71796

32.80 PHOTON INTERACTIONS WITH ATOMS

70824 High-resolution laser spectroscopy of alkali atoms. S.Nakayama (Kyoto Inst. of Technol., Kyoto, Japan).
Mem. Fac. Ind. Arts Kyoto Tech. Univ. Sci. & Technol. (Japan), vol.31, p.40-58 (Dec. 1982). [received: May 1983]
New laser techniques, pulsed and continuous, which make it possible to see optical spectra without Doppler broadening and to enhance sensitivity, are opening new fields with many applications. The determination of structures of alkali atoms is attractive because, being relatively simple atoms with one-electron system, they are good subjects for theoretical studies of modern atomic physics. Some of these measurements of alkali atoms by using high-resolution laser spectroscopy are among the most precise tests of quantum electrodynamics. Quantum beat spectroscopy by a pulsed laser and polarization spectroscopy by a continuous laser are presented as promising high-

resolution spectroscopic techniques for the study of alkali atoms. Lifetimes, hyperfine structures, collisional cross sections of Rydberg (highly-excited) states of cesium have been investigated by quantum beat spectroscopy. Radiative lifetimes and hyperfine interaction constants are found to follow the trends established for lower values of principal quantum numbers, but the measured collisional cross sections are smaller than the extrapolated values. Hyperfine and Zeeman structures of sodium have been examined by using polarization spectroscopy. Although the principal Zeeman structures are resolved, the signals are confusing because of the very large number of cross-over resonances. An interpretation is given, based on a combination of a first-order theory of optical pumping with the theory of dichroism and Faraday rotation. (33 refs.)

Electron scattering in intense laser fields .... See Entry 71013

32.80B Level crossing and optical pumping

70825 Steady state signal in the limit of weak optical pumping with D_1 or D_2 line. S.Legowski, P.Rudecki (Inst. of Phys., Nicholas Copernicus Univ., Torun, Poland).
Z. Phys. A (Germany), vol.310, no.4, p.263-7 (1983).
The simplified rate equations for electronic polarization of alkali atoms in the hyperfine ground states are shown for circularly polarized D_1 and D_2 lines in the limit of weak pumping. The rate equations include effects due to collisional and spin exchange relaxation of atoms in the ground state. Analytical forms of the repopulation pumping terms are shown assuming the standard J-randomization model for relaxation of alkali atoms in resonant ^2P_J states and neglecting energy transfer. Analyses of the analytical steady state solutions have been performed to determine the conditions at which the longitudinal electronic orientation of alkali atoms $\langle S_z \rangle$ and the orientation of atoms in hyperfine sublevels $\langle S_z \rangle_F$ pass through zero. (21 refs.)

Laser studies of electronic energy transfer in atomic copper ... See Entry 70807

Multipole interference in the excitation of helium by simultaneous electron and laser photon impact .... See Entry 71018

Numerical study of overpopulation density for laser oscillation in recombining hydrogen plasmas .... See Entry 71689

32.80D Autoionization

70826 Autoionisation of the higher shells of an atom during β-decay. T.A.Churakova, Yu.G.Smirnov (Voronezh State Univ., Voronezh, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.5, p.71-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.5, p.910-13 (1982). [received: May 1983] (Materials of the Thirty-First All-Union Conference on Nuclear Spectroscopy and the Structure of the Atomic Nucleus, Samarkand, USSR, April 1981).
Describes a further generalisation of the expressions derived by Batkin et al. (1981) for the case of autoionisation of an arbitrary shell during β-decay of any forbiddenness order. The specific numerical calculations were carried out in the nonrelativistic approximation in a more realistic screened potential for the case autoionisation of the L-shell for β-decay of ^{143}Pr, ^{147}Pm, ^{152}Sm, ^{204}Tl and ^{210}Bi. (17 refs.)

70827 Perturbation of the Ba 6sng series at n=24 by zero-field spectroscopy and forced autoionization. T.F.Gallagher, F.Gounand, R.Kachru, N.H.Tran, P.Pillet (SRI Internat., Menlo Park, CA, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2485-92 (May 1983).
The authors report the study of a sharp perturbation of the Ba $6sng\ ^1G_4$ series at $n=24$ by a $5d7d$ level converging to the excited Ba^+5d limit. They compare the traditional spectroscopic approach of determining the strength of the configuration interaction by energy-level perturbations to the values obtained by forced autoionization in an electric field. While the energy of the perturbing $5d7d$ level can be determined accurately by either approach they find a significant difference in the apparent strengths of the configuration interaction. (19 refs.)

32.80F Photoionization and photodetachment

70828 Wave operators for atomic photo-ionisation. H.G.Muller, A.Tip (FOM-Inst. for Atomic & Molecular Phys., Amsterdam, Netherlands).
J. Phys. A (GB), vol.16, no.8, p.1641-60 (1 June 1983).
The time development of a system consisting of an atom in an external electromagnetic field with fixed propagation direction is studied (vector potential $A(x,t)=A(x_3-ct)$). It is shown that the Moller wave-operators, relevant for photo-ionisation, exist, provided the components $A_\sigma(u)$ of A decay as $|u|^{-1-\epsilon}$, $\epsilon>0$, for large argument u. Since $A(x,t)$ is not necessarily spatially homogeneous, the above results can serve as a starting point for an investigation of field-gradient effects on photo-ionisation processes. (17 refs.)

70829 Inner-shell photoionisation in molecules: the carbon monoxide case. S.Krummacher, V.Schmidt (Fakultat fur Phys., Univ. Freiburg, Freiburg, Germany), F.Wuilleumier, J.M.Bizau, D.Ederer.
J. Phys. B (GB), vol.16, no.10, p.1733-47 (28 May 1983).
The inner-valence-shell photoionisation of CO has been studied by electron spectrometry using monochromatised synchrotron radiation in the region of 34 to 100 eV. The analysis of the experimental data and the quantitative comparison with theoretical calculations illustrate the important role electron correlation and shape resonances play in the explanation of the main features of these photoelectron spectra. (40 refs.)

70830 Relativistic many-body approach to the photoionization of cesium. W.R.Johnson (Inst. fur Theoretische Phys., Johann Wolfgang Goethe-Univ., Frankfurt am Main, Germany), G.Soff.
Phys. Rev. Lett. (USA), vol.50, no.18, p.1361-4 (2 May 1983).
A relativistic many-body technique which includes particle-hole excitations of the atomic core is developed to describe the photoexcitation of alkali atoms. The technique is used to study the photoionization of cesium near threshold, where the dipole amplitudes are sensitive to both relativistic and correlation effects. The predicted photoionization amplitudes are free from the gauge ambiguities of Dirac-Fock calculations and are in good agreement with semiempirical calculations and with measurements. (20 refs.)

70831 Multiply charged ions induced by multiphoton absorption in rare gases at 0.53 μm. A.l'Huillier, L.A.Lompre, G.Mainfray, C.Manus (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Phys. Rev. A (USA), vol.27, no.5, p.2503-12 (May 1983).
Up to quadruply charged ions are induced in Xe atoms by a 50-psec laser pulse at 0.53 μm in the 10^{12} W cm^{-2} range. The mechanism of the formation of Xe^{2+} ions is elucidated. In the lowest intensity range, Xe^{2+} ions are produced by direct 15-photon absorption from the ground state of the atoms, while at a higher intensity Xe^{2+} ions are produced by a stepwise process via Xe$^+$ ions. These two processes take place at distinctly different intensities. A kinetic model using rate equations affords a good fit with experimental results. Moreover, for the first time it was possible to obtain the multiphoton ionization cross sections related to the two-electron removal from Xe atoms, as well as the one-electron removal from Xe$^+$ ions. (19 refs.)

70832 Angular distribution of 3d photoelectrons in the 3p resonance region of atomic Mn. M.O.Krause, T.A.Carlson (Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.31-2
The authors characterized the resonance region around the 3p level of atomic manganese by both the 3d partial cross section and the 3d photoelectron angular distribution parameter. They study the energy range from 25 to 100 eV, but emphasize the resonance region between about 47 and 60 eV. (3 refs.)

Non-Hermitian dynamics of multiphoton ionisation .... See Entry 70834

32.80H Auger effect and inner-shell ionization

70833 The *KLL* Auger spectrum of manganese. V.Brabec, O.Dragoun, M.Rysavy, M.Fiser, A.Kovalik (Nuclear Phys. Inst., Czechoslovak Acad. of Sci., Prague, Czechoslovakia), I.Cserny, I.Kadar.
Z. Phys. A (Germany), vol.311, no.1-2, p.37-9 (1983).
The *KLL* Auger electrons of manganese (Z=25) emitted in the ^{55}Fe decay were measured using an electrostatic spectrometer. The computer analysis of the spectra yielded intensity ratios, which agree in all but one item within one standard deviation with the relativistic calculations in the intermediate coupling scheme with configuration interaction. (9 refs.)

Deexcitation rates and fluorescence yields of highly stripped atoms .... See Entry 70809

32.80K Multiphoton processes

70834 Non-Hermitian dynamics of multiphoton ionisation. H.C.Baker (Dept. of Phys. & Astron., Univ. of Kentucky, Lexington, KY, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1579-82 (16 May 1983).
The construction of physical transition probabilities in non-Hermitian, effective-Hamiltonian models of multiphoton ionisation is analysed. Eigenstates of the effective Hamiltonians, $\bar{H}$ and $\bar{H}^\dagger$, are respectively determined to be projected incoming and outgoing states. These models are found to be intrinsically S-matrix models, and the adiabatic eigenstates are used to construct appropriate transition amplitudes. The intermediate-time bound-electron population differs quantitatively from customary norm-of-state constructions. (10 refs.)

Non-monotonic variation of the quantum defect in Cs nD_J term series .... See Entry 70801

Multiply charged ions induced by multiphoton absorption in rare gases at 0.53 μm .... See Entry 70831

Precise determination of the ground state hyperfine splitting of ^{135}Ba$^+$ .... See Entry 71032

33.00 MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS

33.10 CALCULATION OF MOLECULAR SPECTRA

70835 On the rotational distribution of N_2 in the Ar-N_2-discharge. The O-O-band of the second positive system. D.Venzke (Zentralinst. fur Elektronenphys., Acad. der Wissenschaften, Institutsteil IV, Berlin, Germany), J.Mizeraczyk, H.Szczepanska, E.Korn.
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.145-51 (1983).
The rotational distribution of the O-O-band of the second positive system of N_2 was determined by the Ornstein method in the glow discharge of an argon-nitrogen mixture at medium pressure. Evidently, for the rotational R- and P-lines some straight lines can be fitted for rotational quantum numbers between 2 and 60 according to usual representation. The slopes of the curves indicate that the Boltzmann distribution does not exist for all the levels. For each of these straight lines can be declared a value of rotational temperature. The dependence of the several rotational temperatures on the discharge current is essentially lower than the corresponding dependence of the gas temperature, which is calculated by means of the energy balance. The influence of the energy transfer from metastable argon atoms to ground-state nitrogen molecules on the rotational distribution seems to be insignificant. Comparisons with rotational distributions in pure nitrogen plasmas point at the influence of interactions between nitrogen species. (16 refs.)

70836 Ab initio second-order Moller-Plesset calculations of the vibrational spectra of cyclobutadiene and its isotopic derivatives. B.A.Hess,Jr., P.Carsky, L.J.Schaad (Dept. of Chem., Vanderbilt Univ., Nashville, TN, USA).
J. Am. Chem. Soc. (USA), vol.105, no.4, p.695-701 (23 Feb. 1983).
Optimum geometry, IR frequencies and intensities were calculated for cyclobutadiene and seven isotopically substituted derivatives with use of SCF/6-31G* and MP2/6-31G* wave functions. Theoretical spectra agree well with experimental where they are known, except that a result that had been interpreted as showing cyclobutadiene to be square is reinterpreted in terms of a mixture of two nonequivalent dideuterio rectangular structures. (22 refs.)

70837 The $B(^2\Sigma^+)\rightarrow X(^2\Sigma^+)$ transition (4050-4500 Å) in HgI. K.S.Viswanathan, J.Tellinghuisen (Dept. of Chem., Vanderbilt Univ., Nashville, TN, USA).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.185-98 (March 1983).
The $B\rightarrow X$ band system (4050-4500 Å) of HgI is photographed and vibrationally analyzed for the isotopically pure species ^{200}Hg^{127}I and ^{200}Hg^{129}I. The assigned bands span v'' levels 5-26 and v' levels 0-13. The least-squares analysis indicates that the previously accepted v'' numbering for this system is one unit too high. Band-profile simulations and Franck-Condon calculations indicate that the internuclear separation (R'_e-R''_e) is 0.49 Å. The ground-state dissociation energy ($\mathcal{D}_e$) is estimated to be 2750±80 cm^{-1}. Spin splitting is found to contribute significantly to the band structure. (24 refs.)

70838 Coiolis intensity perturbations of the ν_4 band of SF_6. W.B.Person, B.J.Krohn (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.229-57 (March 1983).
In the ν_4 band of $^{32}SF_6$ the intensity of absorption by the *R* branch has been found to exceed that of the *P* branch by 38%. This is substantially larger than the 15% excess that one calculates from ordinary rotational statistics and the nonnegligible width of the band. The authors attribute this imbalance to Coriolis interactions between the rovibrational sublevels (a) of the ν_3 and ν_4 excited vibrational states, and (b) of the ground vibrational state and the $l=1$ (F_{1g}) level of the $\nu_3+\nu_4$ combination state. The intensities of the observed *P*- and *R*-branch lines have a superposed Herman-Wallis type F factor of the form $F(m)=(1+\xi_4 m)^2$, where $m=-J$ for the *P* branch, 0 for the *Q* branch, and $+(J+1)$ for the *R* branch, and *J* is the rotational sublevel in the ground state. The authors determined ξ_4 by a new method from the relative intensities of the *P*, *Q*, and *R* branches. New evidence is reported that supports an earlier conclusion that the first derivatives of the dipole moment function, $\mu_3=\partial\mu/\partial q_3$ and $\mu_4=\partial\mu/\partial q_4$, have the same sign. The corresponding Coriolis effect is calculated for UF_6. It is predicted that Coriolis interactions induce weak absorption in the ν_6 bands of SF_6 and UF_6, which would otherwise be inactive according to selection rules for strong infrared absorption or Raman scattering. An order-of-magnitude estimate of the absorption intensity of the induced ν_6 band of SF_6 agrees with a recent observation of that infrared spectral region. (50 refs.)

70839 *r*-centroids and Franck-Condon factors for the *b′-X* and *b′-b* band systems of the NO^+ molecule. R.R.Reddy (Dept. of Phys., KSRM Coll. of Engng., Cuddapah, India), T.V.R.Rao.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.563-4 (June 1983).
The *r*-centroids and Franck-Condon factors for bands of the *b′-X* and *b′-b* systems of the NO^+ molecule have been evaluated by using an approximate analytical method of Jarmain and Fraser (1953). The appearance of some of the bands is discussed in terms of FC factors. (4 refs.)

70840 Vibrational-vibrational and vibrational-translational/rotational processes in methane, oxygen gas-phase mixtures optoacoustic measurements. E.Avramides, T.F.Hunter (School of Chem. Sci., Univ. of East Anglia, Norwich, England).
Mol. Phys. (GB), vol.48, no.6, p.1331-43 (20 April 1983).
Various methane-oxygen mixtures of different compositions and total pressures were studied optoacoustically for vibrational-vibrational and vibrational-rotational/translational characteristics. *V-R*, *T* rates for CH_4-CH_4 and CH_4-O_2 were measured as respectively 0.645 and 0.105 μs^{-1} atm^{-1}. The rate-constants for transfer between the $CH_4(\nu_2, \nu_4)$ bending modes and the oxygen fundamental, ν, are 12 ± 2 μs^{-1} atm^{-1} for $\nu\rightarrow(\nu_2, \nu_4)$ and 1.1 ± 0.2 μs^{-1} atm^{-1} for $(\nu_2, \nu_4)\rightarrow\nu$. The excitation was to $CH_4(\nu_3)$ with a He-Ne laser and, following very fast equilibration with $CH_4(\nu_1)$, three routes of deactivation were followed in O_2 collisions: (i) to the $CH_4(2\nu_4)$ level and thence by CH_4 collisions to the ν_4 fundamental, (ii) to the O_2 overtone (2ν), followed by the O_2 intermolecular process to the fundamental, and (iii) to the O_2 fundamental plus one CH_4 bending mode. Rate constants for routes (i), (ii) and (iii) are given. (15 refs.)

70841 Application of the perturbation-matrix method to exact calculations of the energies and matrix elements of the vibrational-rotational transitions in diatomic molecules. I.I.Tugov, V.P.Chernyavskii.
Opt. & Spectrosc. (USA), vol.53, no.3, p.256-60 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.435-42 (Sept. 1982). [received: May 1983]
A general approach to the solution of the radial Schrodinger equation with an effective internuclear potential, which is essentially the analytical method of the perturbed Morse oscillator and, in its calculation technique, the perturbation matrix method, is examined. The exact solutions and matrix elements are determined by means of recurrence matrix relationships. In contrast to numerical integration methods, solutions can readily be obtained for high vibrational levels ν and large $\Delta\nu$. The efficiency of the method is demonstrated for the case of CO. The accuracy of the calculation of the characteristic values of the energy reaches 5×10^{-5} cm^{-1}. The results of calculations of the matrix elements of vibrational-rotational transitions for ν=0-35, $\Delta\nu$=0-4, and J=0, 50, 100 are given. (25 refs.)

70842 Normal coordinates analysis of the hexamminochromium (III) ion. A simplified $M(NX)_6$ model. R.Acevedo (Dept. of Chem. Engng., Univ. of Chile, Santiago, Chile), G.Diaz.
Spectrosc. Lett. (USA), vol.16, no.3, p.199-206 (1983).
A normal coordinates analysis for the hexamminochromium (III) ion in octahedral symmetry has been undertaken. A simplified $M(NX)_6$ model has been adopted, since many of the gerade vibrational frequencies are still unknown. A very simple and consistent force field is able to reproduce the observed vibrational frequencies as well as giving a reasonable set of force constant for this complex ion. This calculation supports the assignments made in literature by several workers. (14 refs.)

70843 Condensed aromatics. XIX. Perylene. S.J.Cyvin, B.N.Cyvin (Div. of Phys. Chem., Univ. of Trondheim, Trondheim, Norway), P.Klaeboe.
Spectrosc. Lett. (USA), vol.16, no.4, p.239-48 (1983).
The simple five-parameter force-field approximations were applied to perylene. The vibrational frequencies were recalculated. New experimental data from infrared and Raman measurements are reported. The force field was used to calculate mean amplitude of vibration and perpendicular amplitude correction coefficients. (17 refs.)

70844 Revised normal coordinate analysis for the $[Fe(CN)_5NO]$ ion. B.N.Cyvin, S.J.Cyvin (Div. of Phys. Chem., Univ. of Trondheim, Trondheim, Norway), A.Zabokrzycka, B.B.Kedzia.
Spectrosc. Lett. (USA), vol.16, no.4, p.249-54 (1983).
A new normal coordinate analysis for $[Fe(CN)_5NO]$ (symmetry C_{4v}) was performed, using Urey-Bradley force constants from a previous analysis (Kedzia et al., 1972). A few errors in the previous work are corrected. Most of the calculated vibrational frequencies are reproduced within 2 cm^{-1}, but one serious discrepancy occurred. In the new set the lowest frequency of species B_1 is 61 cm^{-1} in contrast to the previously reported value of 223 cm^{-1}. (3 refs.)

70845 Spectra of infrared transitions between highly excited states of polyatomic molecules. A.A.Makarov, V.V.Tyakht (Inst. of Spectroscopy, Acad. of Sci., Troitsk, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.274-81 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.502-15 (Aug. 1982). [received: May 1983]
It is shown that the average spectral characteristics of a highly excited polyatomic molecule (anharmonic shift, broadening, and integrated absorption cross section) can be determined from the constants of the vibrational spectra of low-lying levels. A study is made of the relationship between the intramolecular broadening of harmonic levels and the spectrum of IR transitions in a quasicontinuum of vibrational states. By way of illustration, a calculation is made for the ν_1 mode of a CF_3I molecule. (25 refs.)

The empirical general harmonic force field of ethane .... See Entry 70765

Self-consistent field vibrational energies for a system of coupled oscillators using the hypervirial and the Hellmann-Feynman theorems ..... See Entry 70766

CNDO/S calculations of resonance Raman spectra and pre-resonance excitation profiles of organic molecules .... See Entry 70777

Singlet cyclobutyne: a relative minimum on the C_4H_4 potential energy hypersurface? .... See Entry 70789

The microwave spectrum of the DO_2 radical .... See Entry 70851

Rotational *l*-type doubling in the $kl=+1$ levels of the ν_4 state of PH_3 .... See Entry 70854

Submillimeter rotational spectrum of nitrogen dioxide $^{14}N^{16}O_2$ .... See Entry 70855

Methylenecyclohexenes: inversion barriers from the far-infrared spectra .... See Entry 70857

Infrared and Raman orientation correlation functions of the ν_3 vibration of N_2O mixed with rare gases .... See Entry 70860

IR-spectroscopic study of isotope effects on the MH/ND-stretching bands of meso-tetraphenylporphine and vibrational hydrogen tunneling .. See Entry 70861

Infrared spectrum of stannous oxide (SnO) .... See Entry 70867

Infrared emission spectrum and potential constants of HCl ..... See Entry 70868

Vibrational spectra and force constants of symmetric tops. Rotational analysis of ν_3 and several hot bands of $H_3Si^{79}Br$ and $H_3Si^{81}Br$ near 430 cm^{-1} .... See Entry 70869

Coriolis perturbation in the fundamentals ν_{11} and ν_{23} of cis, cis-1,4-D_2-buta-1,3-diene .... See Entry 70870

Line strength measurements using diode lasers: the ν_2 band of H_2S .... See Entry 70871

Absorptivity of nitric oxide in the fundamental vibrational band .... See Entry 70872

Vibrational spectra and force constants of symmetric tops—rotational analysis of the ν_2, ν_5, $\nu_3+\nu_6$ infrared system of H_3SiI near 900 cm^{-1} .. See Entry 70874

Excitation and relaxation of the ν_3 vibration of the OsO_4 molecule in a low-temperature xenon matrix .... See Entry 70875

Studies of isolated GeH stretching frequencies. I. Data, assignments and effects of conformation .... See Entry 70876

Studies of isolated GeH stretching frequencies. II. Substituent and inductive effects .... See Entry 70877

Vibrational spectroscopic studies on some 2-substituted 1,3-dithia-2-phospha- and 2-arsa-cyclopentanes .... See Entry 70878

Spectroscopic studies of the v_2 mode of methyl iodide by Raman spectroscopy .... See Entry 70881

Determination of A_0 and D_K for CD_3I from the ν_4 Raman and IR bands .... See Entry 70883

Time-resolved resonance Raman study of transient benzooxazolinic merocyanines .... See Entry 70884

Vibrational spectra of bromocyclopropane .... See Entry 70885

Applications of four-channel Raman difference spectroscopy to studies in hydrogen-bonded systems .... See Entry 70886

Coherent anti-Stokes Raman spectra of isoalloxazines .... See Entry 70887

Vibrational spectra and analysis of Te_6^{4+}, a trigonal-prismatic cluster cation .... See Entry 70889

The electronic absorption spectrum of $I\text{-}C\equiv C\text{-}C\equiv C\text{-}I^+$ in a Ne matrix .... See Entry 70890

Rotational analysis of the $^2B_1$ $(K'=0)\leftarrow{}^2A_1$ $(K''=1)$ bands with $\nu_2'=6$, 7 and 10 in the excitation spectrum of NO_2 .... See Entry 70891

The UV spectrum of ^{18}OD .... See Entry 70895

Rotationally resolved photofragment alignment and the vacuum ultraviolet photodissociation of H_2O .... See Entry 70932

The spectroscopy and single vibronic level fluorescence quantum yields of jet cooled trans-stilbene and its Van der Waals complexes .... See Entry 70938

Time-resolved fluorescence spectra of rotationally cooled NO_2 .... See Entry 70941

Laser photoelectron spectroscopy of MnH^- and FeH^-: electronic structures of the metal hydrides, identification of a low-spin excited state of MnH, and evidence for a low-spin ground state of FeH .... See Entry 70947

The HeI excited electron spectrum of phosphine—an experimental and theoretical study .... See Entry 70951

Relative intensities of *P*, *Q*, and *R* branches of ν_4 of SF_6 .... See Entry 70956

Molecular beam photoionization study of H_2S .... See Entry 70961

Weak Van der Waals complexes of the X...BC type: calculation of linewidths of metastable levels .... See Entry 70966

Energy levels and photopredissociation of the He-I_2 van der Waals complex in the IOS approximation .... See Entry 70969

Photodissociation of triatomic molecules: rotational scattering effects .... See Entry 70970

The dynamics of ethylene dimer infrared photodissociation in pulsed molecular beams .... See Entry 70971

Infrared-microwave two-photon spectra of the ν_3 bands of $^{12}CH_3F$ and $^{13}CH_3F$ .... See Entry 70974

The $\tilde{A}^1B_2$-$\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,3-difluorobenzene .... See Entry 70975

Calculated ro-vibrational fine-structure spectrum and weak-field Zeeman splittings of the O_2Ar van der Waals molecule .... See Entry 70979

Computation of spectroscopic constants of some diatomic hydrides using Morse-Kratzer potential model .... See Entry 70981

Dunham coefficients for seven isotopic species of CO .... See Entry 70983

Structure and quadrupole coupling measurements on the NO dimer .... See Entry 71036

On vibrational bonding of IHI .... See Entry 71037

Observation of the $\nu=1\leftarrow0$ band of SH $(X^2\Pi)$ with a difference frequency laser .... See Entry 71039

Magnetic electronic Raman optical activity of osmium (IV) hexabromide, iridium (IV) hexachloride and uranocene .... See Entry 72797

Rotational energy distributions in molecule surface scattering: model calculations for NO/Ag(111) .... See Entry 72908

Simultaneous excitation of rotations and surface phonons in the scattering of D_2 from a NaF crystal .... See Entry 72921

Spectral line parameters for the pure rotation bands of solar OH .... See Entry 74064

33.20 MOLECULAR SPECTRA GROUPED BY WAVELENGTH RANGES

(for magneto-optical and electro-optical spectra, see 33.45; for fluorescence and phosphorescence spectra, see 33.50; for photoelectron spectra, see 33.65)

70846 Electronic spectra of biphenylene and diazabiphenylenes. H.Yamaguchi, M.Ata (Dept. of Chem., Kumamoto Univ., Kumamoto, Japan), J.F.W.McOmie, J.W.Barton, H.Baumann.
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.599-609 (April 1983).
The absorption, linear dichroism (l.d.) and magnetic circular dichroism (m.c.d.) spectra of biphenylene (**1**), 1,8-diazabiphenylene (**2**) and 2,7-diazabiphenylene (**3**) have been measured. The c.d. spectra of the β-cyclodextrin complexes with **1**, **2** and **3** have also been measured. The first $[(23.0\text{-}36.0)\times10^3\ \mathrm{cm}^{-1}]$ and second $[(36.0\text{-}50.0)\times10^3\ \mathrm{cm}^{-1}]$ absorption bands of **1**, **2** and **3** have been assigned by using the observed spectra and the results of CNDO/S CI calculations. It is concluded that the b_{3u} vibration with a frequency of ca. 780 cm^{-1} takes part in the vibronic coupling between the first and second excited singlet states of **1** and that the second absorption band of **1** is composed of two electronic transitions polarised along the short and long axes. (43 refs.)

70847 Spectroscopy, structure and bonding of high temperature metal halide vapor complexes. G.N.Papatheodorou (Dept. of Chem. Engng., Univ. of Patras, Patras, Greece).
In book: *Current topics in materials science. Vol.10*, E.Kaldis [Ed.], p.249-352. Amsterdam, Netherlands: North-Holland (1982), vi+515 pp. [0 444 86321 4]
The author reviews the available spectroscopic information on the electronic (mainly absorption) and vibrational (mainly Raman) properties of metal halide vapor complexes. Conclusions regarding molecular structures and the correlation of structure with thermodynamic properties are also reviewed. (180 refs.)

Spectroscopy of molecular crystals. A bibliography for 1980 ..See Entry 69810

Triplet 4*d* states of H_2: experimental observation and comparison with an ab initio model for Rydberg-state energies .... See Entry 70795

On the interaction operator in the optical spectroscopies with spin .... See Entry 70960

Bound-free spectroscopy of Cs_2^+ .... See Entry 70972

33.20B Radiofrequency and microwave spectra

(for NMR spectra, see 33.25; for EPR spectra, see 33.30)

70848 Fluorescence excitation of CO in comets. K.S.Krishna Swamy (Tata Inst. of Fundamental Res., Bombay, India).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.882-5 (15 April 1983).
A complete modeling of the CO molecule based on the resonance fluorescence excitation process shows that the triplet-singlet transitions (Cameron bands) should be observable in comets. The expected intensities of these bands for Comet West (1976 VI) are consistent with the observations of Smith et al. (1980). The Angstrom bands arising out of the singlet states may also be observable. The expected intensities of vibrational and rotational transitions are also discussed briefly. (17 refs.)

70849 Determination of the dipole moment of nitrosyl fluoride in the (001) and (101) states by combination of microwave and laser Stark data. G.Cazzoli, C.Degli Esposti, P.G.Favero (Centro di Studio di Spettroscopia a Microonde, Univ. di Bologna, Bologna, Italy).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.664-8 (29 April 1983).
The combination of microwave measurements of the Stark effect in the (001) excited vibrational state with fourteen laser Stark transitions of the hot band $(101)\leftarrow(001)$, previously reported in the literature, yielded the values of the dipole moment of ONF both in the (001) and (101) states. (7 refs.)

70850 Electric dipole moments of $(HC^{15}N)_2$ and $HC^{15}NH^{35}Cl$. E.J.Campbell, S.G.Kukolich (School of Chem. Sci., Univ. of Illinois, Urbana, IL, USA).
Chem. Phys. (Netherlands), vol.76, no.2, p.225-9 (15 April 1983).
The electric dipole moments of two linear hydrogen-bound complexes containing HCN have been measured using pulsed Fourier-transform microwave spectroscopy carried out in a Fabry-Perot cavity. The dipole moment of $(HC^{15}N)_2$ is 6.552(35) D and the dipole moment of $HC^{15}NH^{35}Cl$ is 4.817(24) D. Both measurements refer to the vibrational ground state. (21 refs.)

70851 The microwave spectrum of the DO_2 radical. S.Saito, Y.Endo, E.Hirota (Inst. for Molecular Sci., Okazaki, Japan).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.138-45 (March 1983).
The *a*-type $N=1\leftarrow0$, $2\leftarrow1$, and $3\leftarrow2$ and the *b*-type, $1_{11}\leftarrow2_{02}$, $2_{12}\leftarrow3_{03}$, $3_{13}\leftarrow4_{04}$, $6_{06}\leftarrow5_{15}$, and $7_{07}\leftarrow6_{16}$ transitions, 14 in total, of the DO_2 free radical in the ground vibronic state were observed by microwave spectroscopy in the frequency region up to 200 GHz. The DO_2 radical was generated in a free-space absorption cell by a DC discharge in a mixture of CH_3OD and O_2. From the observed spectra the rotational constants, centrifugal distortion constants, spin-rotation coupling constants, and magnetic hyperfine coupling constants were determined with good precision. The hyperfine coupling constants of DO_2 were determined by the present work for the first time. A comparison of the in-plane components of the dipole-dipole interaction tensor of DO_2 with those of HO_2 made it possible to determine the off-diagonal component T_{ab}, and thus the principal values and the principal axes of the tensor. (22 refs.)

70852 1-butyne microwave spectrum, barrier to internal rotation, and molecular dipole moment. B.M.Landsberg (Univ. Coll. of North Wales, Bangor, Wales), R.D.Suenram.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.210-20 (March 1983).
Measurements of rotational transitions of 1-butyne have been made in the range of $\sim$20-130 GHz. Both *a*-type transitions up to $J=46$ and *b*-type transitions up to $J=42$ have been measured and fitted to a rotational Hamiltonian which includes centrifugal distortion terms. In addition to the five quartic centrifugal distortion constants, three sextic coefficients had to be included to reproduce the observed frequencies to within experimental error. The results of the analysis are sufficient for the prediction of all strong transitions throughout the millimeterwave range. A barrier to internal rotation of the methyl group of 3.260 kcal/mole (1 kcal/mole=4.18 kJ/mole) has been derived from the first excited torsional state. Analysis of the second-order Stark effect has led to an accurate determination of both μ_a and μ_b with $\mu_a=0.763(3)$ D and $\mu_b=0.170(4)$ D. (13 refs.)

70853 Microwave spectral study of cyclopentyl acetylene. R.N.Nandi, M.D.Harmony (Dept. of Chem., Univ. of Kansas, Lawrence, KS, USA).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.221-8 (March 1983).
The microwave spectrum of cyclopentyl has been observed and analyzed in the 26.5-40 GHz frequency range. Rotational constants have been obtained for the axial and equatorial conformers as follows (in MHz): $A=4264.820\pm0.429$, $B=2168.762\pm0.009$, $C=2032.080\pm0.009$ for the axial; $A=6349.374\pm0.399$, $B=1765.183\pm0.012$, $C=1480.549\pm0.013$ for the equatorial. Relative intensity measurements showed the equatorial conformer to be more stable by 270±70 cal/mole. A low-frequency ring mode having a fundamental frequency of $40\pm20\ \mathrm{cm}^{-1}$ was observed up to $v=6$. The conformational parameters and pseudorotational potential energy surfaces for various monosubstituted cyclopentanes have been compared and discussed. (14 refs.)

70854 Rotational *l*-type doubling in the $kl=+1$ levels of the ν_4 state of PH_3. S.P.Belov, A.F.Krupnov (Inst. for Appl. Phys., Acad. of Sci., Gorkii, USSR), D.Papousek, S.Urban, G.Cazzoli.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.265-8 (March 1983).
High resolution infrared and microwave studies of rotational *l*-type doubling in symmetric top molecules give valuable information on the anharmonicity of the molecular potential function. It has also been shown recently that transitions between the *l*-type doublets are suitable for interesting microwave-infrared double resonance experiments. Scappini and Schwartz (1981) and Guarnieri et al. (1981) have recently measured the first three direct $(\Delta J=0)$ *l*-doublet transitions in the $\nu_4=1$ state of $PH_3(kl=+1;\ J=1,\ 2,\ 3)$. The authors have extended this measurement to the $J=4$ state and to the $J+1\leftarrow J$ transitions for $J=1$, 2. The microwave $(\Delta J=0)$ and submillimeterwave $(\Delta J=+1)$ transition frequencies are internally consistent within the accuracy of experiment; they are also consistent with the assignments of the ν_4 band transition frequencies published by Tarrago et al. (1981). (12 refs.)

70855 Submillimeter rotational spectrum of nitrogen dioxide $^{14}N^{16}O_2$. O.I.Baskakov, M.V.Moskienko, S.F.Dyubko.
Opt. & Spectrosc. (USA), vol.53, no.3, p.270-2 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.457-61 (Sept. 1982). [received: May 1983]
The frequencies of 96 rotational lines of the ground vibrational state of the $^{14}N^{16}O_2$ molecule have been measured and identified in two sections of the submillimeter range: 300-400 and 657-670 GHz. The rotational, centrifugal, spin-rotational, and spin-spin constants have been calculated. (22 refs.)

Infrared-microwave two-photon spectra of the ν_3 bands of $^{12}CH_3F$ and $^{13}CH_3F$ .... See Entry 70974

Structure and quadrupole coupling measurements on the NO dimer .... See Entry 71036

Observation of the $v=1\leftarrow0$ band of SH $(X^2\Pi)$ with a difference frequency laser .... See Entry 71039

33.20E Infrared spectra

70856 IR bandshapes of weakly H-bonded systems. II. Complexes of methyl-phenol derivatives with dioxane. B.Czarnik-Matusewicz, J.P.Hawranek (Inst. of Chem., Univ. of Wroclaw, Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.563-9 (April 1983).
IR spectra of hydrogen-bonded complexes of four methyl-phenol derivatives with dioxane were measured. A detailed analysis of shape of the stretching vibration band of the proton donor group in these systems was carried out both for the absorbance spectrum $A(\nu)$ and absorption index spectrum $k(\nu)$, yielding profile parameters, band moments, asymmetry factors, correlation functions and correlation times. The results were discussed in terms of Robertson's and Yarwood's theory (1978). (15 refs.)

70857 Methylenecyclohexenes: inversion barriers from the far-infrared spectra. T.L.Smithson, N.Ibrahim, H.Wieser (Dept. of Chem., Univ. of Calgary, Calgary, Alberta, Canada).
Can. J. Chem. (Canada), vol.61, no.3, p.442-53 (March 1983).
The far-infrared spectra of 3-methylenecyclohexene, 4-methylenecyclohexene, and 1-methyl-3-methylenecyclohexene in the region of 80-400 cm^{-1} are reported and interpreted mainly with a view to the two lowest out-of-plane deformations of the cyclohexene ring. Typical C-type band sequences are observed and interpreted in terms of ring inversion modes. Barriers to inversion are determined by means of a one-dimensional Hamiltonian with a quadratic-quartic potential function. Possible ground state geometries and forms of the inversion coordinates are discussed and compared to those thought to occur in the analogous cyclohexenones. (22 refs.)

70858 Vibrational kinetics in He-CO reacting discharges. S.De Benedictis, C.Gorse, M.Cacciatore, M.Capitelli, F.Cramarossa, R.D'Agostino (Dipartimento di Chimica, Univ. Bari, Bari, Italy), E.Molinari.
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.674-7 (29 April 1983).
Combined measurements of vibrational distributions (N_v) of CO and CO_2 yields (β) in He-CO discharges have been performed at different residence times in radiofrequency discharges. The experimental results on N_v have been obtained by IR emission spectroscopy and on β by gas-chromatographic and mass-spectrometric techniques. A theoretical model including the most important relaxation channels of the vibrational energy has been set up and coupled to the plasma chemistry describing the rate of formation of species such as CO_2, C, and O. Theoretical and experimental results are in good agreement, emphasizing the role of a vibrational mechanism in dissociating CO in He-CO mixtures. (14 refs.)

70859 Infrared and Raman spectra of Ag(I) and Hg(II) complexes of 1-methylthymine. F.Guay, A.L.Beauchamp (Dept. de Chimie, Univ. de Montreal, Montreal, Quebec, Canada), C.Gilbert, R.Savoie.
Can. J. Spectrosc. (Canada), vol.28, no.1, p.13-20 (1983).
The infrared (4000-200 cm^{-1}) and Raman spectra (3100-50 cm^{-1}) of solid samples of 1-methylthymine, the N3-deuterated derivative, and the complexes with CH_3Hg^+, Ag^+ and Hg^{2+} are reported. The Raman spectra of H_2O and D_2O solutions of 1-methylthymine, the anionic form (pH 12) and the CH_3Hg^+ complex are also described. The most interesting regions of these spectra are discussed in connection with the deprotonation and complexation taking place at position N3, and with the secondary interactions involving the carbonyl groups. (31 refs.)

70860 Infrared and Raman orientation correlation functions of the ν_3 vibration of N_2O mixed with rare gases. C.Dreyfus, R.Ouillon, L.Berreby (Dept. de Recherches Phys., Univ. Pierre & Marie Curie, Paris, France).
J. Chem. Phys. (USA), vol.78, no.9, p.5379-83 (1 May 1983).
IR and Raman orientational correlation functions are obtained from the corresponding profiles of the ν_3 band of N_2O at near-identical experimental conditions. The influence of the leak of polarized light is estimated for Raman scattering. The experimental correlation functions corrected for hot bands, are compared to the usual theoretical rotational diffusion models. None of the models fits both the IR and Raman correlation functions. A very good agreement is observed with the Steele perturbation theory, which introduces as the only parameter the mean square torque exerted on the molecule by the medium. (13 refs.)

70861 IR-spectroscopic study of isotope effects on the MH/ND-stretching bands of meso-tetraphenylporphine and vibrational hydrogen tunneling. H.-H.Limbach, J.Hennig, J.Stulz (Inst. fur Phys. Chem., Univ. Freiburg, Freiburg, Germany).
J. Chem. Phys. (USA), vol.78, no.9, p.5432-6 (1 May 1983).
The IR spectra of meso-tetraphenylporphine (TPP) dissolved in CCl_4 have been measured in the NH and ND stretching band region as a function of isotope substitution using a newly constructed vacuum IR cell. Thus, it was possible for the first time to localize the NH and ND stretching bands of TPP-HD, which are characterized by the wave numbers 3335 and 2493 cm^{-1}. TPP-H_2 and TPP-D_2 were found to absorb at lower frequencies, namely 3318 and 2482 cm^{-1}. The observation of this band shift allows one to identify the observed NH and ND stretching bands in TPP-H_2 and TPP-D_2. They arise from antisymmetric stretching vibrations, the symmetric bands being forbidden in the IR spectra. NH/ND stretching bandwidths of the order of 20 cm^{-1} were observed, which is usually small for proton transfer systems. This observation further confirms the authors previous conclusions from the primary HH/HD/DD kinetic isotope effects on the tautomerism in this molecule, namely that the motion of the hydrogen atoms takes place in a coupled manner from discrete vibrational NH stretching levels without substantial coupling to the motion of heavy atoms. Since the symmetric NH stretching vibration has a higher frequency than the antisymmetric stretching vibration, the interaction between the two inner hydrogen atoms in TPP is repulsive. (46 refs.)

70862 Low-temperature infrared spectrum of chlorine nitrate and evidence for the existence of ClOONO. S.C.Bhatla, M.George-Taylor, C.W.Merideth, J.H.Hall,Jr. (School of Geophys. Sci., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1091-3 (31 March 1983).
The authors report the matrix-isolated-infrared spectra of chlorine nitrate. The spectra of both synthetic chlorine nitrate and chlorine nitrate produced in the $ClO+NO_2+M\rightarrow products+M$ reaction show infrared absorptions which may be associated with $ClONO_2$ and ClOONO isomers. The infrared absorption frequencies for ClOONO are assigned. (17 refs.)

70863 Interconversion studies and characterization of asymmetric and symmetric dinitrogen trioxide in nitric oxide matrices by Raman and infrared spectroscopy. E.M.Nour, L.-H.Chen, J.Laane (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1113-20 (31 March 1983).
The first laser Raman spectra of both asymmetric dinitrogen trioxide (O_2NNO) and symmetric dinitrogen trioxide (ONONO) have been collected by stabilizing these species in nitric oxide matrices at 12K. Laser irradiation at wavelengths from 5682 to 7526 Å converts as-N_2O_3 to *s*-N_2O_3 but wavelengths of 5145 or 4880 Å convert the symmetric isomer back to the asymmetric one. The Raman data along with the infrared spectra of several isotopic species (with ^{15}N and/or ^{18}O) for both molecules made it possible to resolve previous ambiguities in the vibrational assignments of these isomers and to carry out meaningful force constant calculations for them. The N-N stretching frequency at 266 cm^{-1} for as-N_2O_3 and its stretching force constant of $f_{NN}=0.57$ mdyn/Å both are characteristic of a very weak bond, although these values are higher than previously proposed. The N-O single bond stretching force constant for *s*-N_2O_3 was determined to be 3.61 mdyn/Å. (17 refs.)

70864 Involvement of amine protons in *n*-butylamine-cresol hydrogen bonding. A.Al Awar, M.Codd, N.Pratt, R.M.Scott (Dept. of Chem., Eastern Michigan Univ., Ypsilanti, MI, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1188-91 (31 March 1983).
Studies of the hydrogen bonding of cresols with *n*-butylamine by difference spectroscopy in the infrared range reveal participation of protons from both the phenols and the amines. A cyclic structure for the interaction is proposed. (11 refs.)

70865 High-resolution photofragment spectroscopy of the O_2^+ $b^4\Sigma_g^-(v'=5\text{-}8)\leftarrow a^4\Pi_u(v''=6\text{-}9)$ first negative system. J.C.Hansen, J.T.Moseley (Phys. Dept., Univ. of Oregon, Eugene, OR, USA), P.C.Cosby.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.48-63 (March 1983).
A laser-ion coaxial beams photofragment spectometer was used to observe absorptions from O_2^+ $a^4\Pi_u(v''=5\text{-}9)$ to predissociated O_2^+ $b^4\Sigma_g^-$ levels in the $v'=5$, 6, 7, and 8 vibrational manifolds. The bands studied were (5,6), (5,7), (6,7), (7,8), and (8,9). The coaxial beams technique was used with a single-mode dye laser and velocity tuning to obtain an overall resolution of 0.003 cm^{-1} in the best cases. A reanalysis of the first negative system, including these data, other bands previously observed in predissociation, and the bands observed in emission at high resolution was performed. The Hamiltonian representation used to determine the molecular constants was that used in the previous study, with the addition of a fine structure term of the form $L_zS_z^3$ in the effective Hamiltonian for the $a^4\Pi_u$ state. This term was significant in the fits for all v'' levels except 8 and 9, where the data are of relatively poor resolution, and improved the fit for the $v''=4$ level by a factor of 5, bringing it into agreement with the experimental uncertainty. In addition to the band-by-band molecular constants, the interconnected bands were combined to calculate merged constants and Dunham coefficients. These constants should provide substantially the most accurate and comprehensive description of the *a* and *b* states of O_2^+ that is currently available. (17 refs.)

70866 Infrared spectra of the matrix-isolated chlorides of iron, cobalt, and nickel. D.W.Green (Chem. Technol. Div., Argonne Nat. Lab., Argonne, IL, USA), D.P.McDermott, A.Bergman.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.111-24 (March 1983).
Iron, cobalt, and nickel metal cathodes were sputtered with various mixtures of $^{37}Cl_2/^{35}Cl_2/Ar$ to produce Ar matrices at 14K that contained the mono-, di-, and trichlorides of the corresponding metal. The measured infrared absorption spectra of these matrices allowed the identification and characterization of $FeCl_2$, $FeCl_3$, CoCl, $CoCl_2$, $CoCl_3$, and $NiCl_2$. The derived vibrational constants of the electronic ground state of $^{59}Co^{35}Cl$ are $\omega_e=457.8\pm3.0$ cm^{-1} and $\omega_ex_e=2.0\pm1.5$ cm^{-1}. The antisymmetric stretching mode frequencies of six isotopomers of $FeCl_2$ and three isotopomers of $CoCl_2$ were identified and measured. The dichlorides of iron, cobalt, and nickel were all determined, in contrast with previous work, to be nonlinear with bond angles of 161, 157, and 161°, respectively. The estimated uncertainty is 5°. For both iron and cobalt trichlorides, the measured stretching mode frequencies were used to derive a Cl-M-Cl angle in excess of 120°, as would be expected for planar molecules with somewhat anharmonic vibrations. Observed adsorption peaks could be assigned to the $\nu_3(E)$ modes of planar (D_{3h}) Fe and Co trichlorides and the corresponding modes of the isotopomers. These observations strongly suggest that recent data supporting a pyramidal geometry for $FeCl_3$ should be reexamined. The geometry of $CoCl_3$ has not previously been determined. (20 refs.)

70867 Infrared spectrum of stannous oxide (SnO). A.G.Maki, F.J.Lovas (Molecular Spectroscopy Div., NBS, Washington, DC, USA).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.146-53 (March 1983).
A tunable diode laser has been used to measure the infrared spectrum of stannous oxide (SnO) in the gas phase between 830 and 868 cm^{-1}. Measurements of the $v=1\text{-}0$, 2-1, 3-2, and 4-3 transitions have been made at temperatures ranging from 930 to 1150°C. Over 175 infrared transitions of the nine most abundant SnO isotopic species have been combined with microwave measurements reported by others in a single least-squares analysis of the data to yield a set of eight Dunham coefficients for the $X^1\Sigma^+$ state of SnO. The data have also been fit by a nonlinear least-squares procedure to obtain B_e, ω_e, and the first five Dunham potential constants. The band center for the vibrational transition of $^{120}Sn^{16}O$ is found at ν_0 $(v=1\text{-}0)=814.70249\pm0.00027$ cm^{-1}. (17 refs.)

70868 Infrared emission spectrum and potential constants of HCl. C.M.Clayton, D.W.Merdes, J.Pliva, T.K.McCubbin,Jr. (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA), R.H.Tipping.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.168-84 (March 1983).
The emission spectrum from a low-pressure hydrogen chloride flame has been recorded in the 3.1-5.3 μm region at high resolution using a 4.5-m grating spectrometer coupled to a PDP-15 computer. The data obtained for the $v\rightarrow v-1$ band sequence, with $v=1$ to 6 for $H^{35}Cl$ and $v=1$ to 5 for $H^{37}Cl$, were combined with other accurate data and analyzed to obtain the vibrational and rotational constants and Dunham coefficients for the $H^{35}Cl$ and $H^{37}Cl$ molecules. Using this information, eighth-order nonlinear least-squares estimates of the Dunham, Simons-Parr-Finlan (1973), Ogilvie (1981), and Sandeman potential constants were computed. While the values of all four sets of constants display a lack of convergence, the constants of Sandeman's expansion exhibit better statistical behavior than the other three. This suggests that a Sandeman-like inversion of the Simons-Parr-Finlan and Ogilvie potential constants would be worthwhile. (33 refs.)

70869 Vibrational spectra and force constants of symmetric tops. Rotational analysis of ν_3 and several hot bands of $H_3Si^{79}Br$ and $H_3Si^{81}Br$ near 430 cm^{-1}. H.Burger, G.Schippel (Anorganische Chem., Univ. Wuppertal, Wuppertal, Germany).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.199-209 (March 1983).
The gas-phase infrared spectra of monoisotope $H_3Si^{79}Br$ and $H_3Si^{81}Br$ in the ν_3 region near 430 cm^{-1} were recorded with a resolution of 0.04 cm^{-1}. The rotational *J* structure of the transitions ν_3, $2\nu_3$-ν_3, $3\nu_3$-$2\nu_3$ $(\nu_3+\nu_6)$-ν_6, and ν_3 of the ^{29}Si isotopomers was analyzed by means of polynomial methods up to *J* values of about 100, and the apparent *k* structure was evaluated by a band contour simulation. The molecular parameters ν_3^0, x_{33}, x_{36}, α_3^A, α_3^B, and D_j have been determined. (14 refs.)

70870 Coriolis perturbation in the fundamentals ν_{11} and ν_{23} of cis, cis-1,4-D_2-buta-1,3-diene. L.Nemes (Res. Lab. for Inorganic Chem., Hungarian Acad. of Sci., Budapest, Hungary), G.Keresztury, G.Jalsovszky, Yu.N.Panchenko, A.-S.Makhniov.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.262-4 (March 1983).
The authors study of vibrational and rotational assignments and Coriolis perturbations for the modes ν_{11} and ν_{23} of the D_2 derivative of 1,3-diene. The perturbations in ν_{11} and ν_{23} bands are strictly analogous to those observed in the parent molecule. Such effects are manifested in the rotational *K* structure which is well resolved in the infrared spectra run on a Nicolet 7199 FT-IR spectrometer at a resolution of 0.06 cm^{-1}. The ground state rotational constants of the dideutero derivative were estimated using the r_{av} geometrical parameters. These estimates, when applied in ground state combination differences, are useful for confirming the *K* assignments of the *Q* branches for perpendicular bands. (9 refs.)

70871 Line strength measurements using diode lasers: the ν_2 band of H_2S. L.L.Strow (NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.395-406 (May 1983).
The strengths of 94 lines in the ν_2 band of H_2S have been measured with an average accuracy of 3% using a tunable diode laser. The line strengths are determined from the peak absorption of nearly Doppler-shaped lines. A detailed error analysis of this measurement method is given. Ratios of the measured line strengths to strengths calculated assuming no vibration-rotation interactions are shown to range from as low as 0.057 to as high as 4.71. (30 refs.)

70872 Absorptivity of nitric oxide in the fundamental vibrational band. R.F.Holland, M.C.Vasquez, W.H.Beattie, R.S.McDowell (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.435-8 (May 1983).
From observations of the spectral absorbance of mixtures of nitric oxide in nitrogen at room temperature, the authors derive an integrated absorptivity for the NO fundamental band of 137.3±4.6 cm^{-2} atm^{-1} at 0°C. The indicated uncertainty is the estimated maximum error. (14 refs.)

70873 Infrared spectroscopic studies of Cu(II) complexes of purine and pyrimidine bases in D_2O solution. C.R.Krishnamoorthy, M.M.Taqui Khan (Dept. of Chem., Indian Inst. of Technol., Madras, India).
J. Coord. Chem. (GB), vol.12, no.4, p.313-16 (1983).
Studies of metal complexes of purine and pyrimidine bases and their derivatives have received considerable attention recently. The present investigation aims to elucidate the proton ionization sites and metal ion binding sites in these ligands in aqueous solution from IR spectroscopic study of these systems in D_2O. The method employed consisted of the IR study of the ligands in pure D_2O solution in the absence and presence of metal ion at a definite pD value. A pH meter with a mini combination glass and calomel electrode was used to measure the pH of the solution. A spectrophotometer using a cell with a teflon spacing of 0.1 mm was used for all IR measurements. (30 refs.)

70874 Vibrational spectra and force constants of symmetric tops—rotational analysis of the ν_2, ν_5, $\nu_3+\nu_6$ infrared system of H_3SiI near 900 cm^{-1}. F.Lattanzi (Dipartimento di Chimica, Univ. della Calabria, Cosenza, Italy), C.di Lauro, H.Burger, P.Schulz.
Mol. Phys. (GB), vol.48, no.6, p.1209-19 (20 April 1983).
The infrared spectrum of H_3SiI in the 800-1050 cm^{-1} region has been recorded with a resolution of 0.04 cm^{-1} and rotationally analysed. Features related to the Fermi resonance between ν_5 and $\nu_3+\nu_6$ and to the Coriolis x, y resonance between ν_2 and ν_5 have been explained, and a set of vibration-rotation parameters for the three bands has been determined by least-squares calculations, $\sigma(J, K)=9.4\times10^{-3}$ cm^{-1}. The Fermi resonance matrix element $|W_{356}|$ is found to be 3.7859(7) cm^{-1} and the vibrational frequencies are $\nu_2{}^0=904.551(1)$, $\nu_5{}^0=941.0746(8)$ and $(\nu_3+\nu_6)^0=953.688(3)$ cm^{-1}. The anharmonicity constant, $x_{36}=-1.745(9)$ cm^{-1}, has been determined. Comparison is made with $\nu_2/\nu_5/\nu_3+\nu_6$ of H_3SiCl, H_3SiBr and H_3GeBr. (15 refs.)

70875 Excitation and relaxation of the ν_3 vibration of the OsO_4 molecule in a low-temperature xenon matrix. A.V.Evseev, N.P.Furzikov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.261-5 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.443-9 (Sept. 1982). [received: May 1983]
OsO_4 molecules in a Xe matrix at $T=9$K and concentrations of 1/400 and 1/800 have been excited to the level $\nu_3=1$ by pulsed IR radiation in resonance with the ν_3 vibration with a frequency of 956 cm^{-1}. Significant multiphoton absorption of the IR radiation was not detected. The IR-IR double resonance method has been used to record the absorption spectrum of vibrationally excited molecules; the spectrum has maxima at frequencies of 949.5 and 946.0 cm^{-1}. The first of these corresponds to the transition $\nu_3=1\rightarrow\nu_3=2$ and the second to a presumably mixed vibrational-librational transition. The measured relaxation time of the level $\nu_3=1$ is 90±35 nsec. (10 refs.)

70876 Studies of isolated GeH stretching frequencies. I. Data, assignments and effects of conformation. D.C.McKean, I.Torto, M.W.Mackenzie, A.R.Morrisson (Dept. of Chem., Univ. of Aberdeen, Aberdeen, Scotland).
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.387-98 (1983).
Isolated GeH stretching frequencies are reported or derived from earlier work for 51 substituted germanes in the gas phase, the substituents including Me, Et, i-Pr, CF_3, Ph, CN, C_2H and X=F, Cl, Br, I. In a number of cases, very small positive stretch-stretch interaction force constants are obtained which reflect the virtual decoupling of bond stretching motions in GeH_3 or GeH_2 groups where the bonds differ but slightly in strength. This may be described as 'local mode' behaviour, in the fundamental region. β-effects of Me, X and lone pairs of electrons are found which produce conformational variations in ν^{is}GeH comparable with those found in carbon analogues. These may be used inter alia to study conformer abundancies. Solid state spectra of GeH_3NCO and GeH_3NCS suggest that both of these have non-linear skeletons in this phase. (53 refs.)

70877 Studies of isolated GeH stretching frequencies. II. Substituent and inductive effects. D.C.McKean, I.Torto, M.W.Mackenzie (Dept. of Chem., Univ. of Aberdeen, Aberdeen, Scotland).
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.399-408 (1983).
For pt.I see ibid., vol.39a, no.5, p.387 (1983). ν^{is}GeH data from the preceding paper are examined for the additivity of substituent effects and for correlation with Taft σ^* values. It is essential to correct for conformational variations in ν^{is}GeH and the evidence indicates that gas based values are preferable to condensed phase ones. α effects of Cl, Me, Et, i-Pr are roughly additive, but successive fluorination increases the increase in νGeH, whereas for other groups effects diminish with further substitution. For alkyl germanes and GeH_4. ν^{is}GeH correlates well with $\Sigma\sigma^*$ according to $\nu=2037+47\ \Sigma\sigma^*$, but data for all other substituents are incompatible and no single correlation is possible, in contrast to earlier findings in this field. Possible reasons for the very different behaviour of alkyl [+1] groups and electronegative [−1] ones are considered. Attempts to evaluate $d_\pi-p_\pi$ bonding contributions from νGeH data should be abandoned. (12 refs.)

70878 Vibrational spectroscopic studies on some 2-substituted 1,3-dithia-2-phospha- and 2-arsa-cyclopentanes. G.Davidson, K.P.Ewer (Dept. of Chem., Univ. of Nottingham, Nottingham, England).
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.419-28 (1983).
Infrared and Raman spectra are reported for dithiaphosphacyclopentanes ($(CH_2)_2S_2E.X$), where E=P,X=Cl, OMe, SMe, NMe_2 or Ph; and E=As, X=Cl, I or NMe_2. Assignments of skeletal modes are made in each case assuming a molecular symmetry of C_s. Internal modes of X can be assigned under the appropriate 'local' symmetry. The skeletal mode assignments for E=P and As are compared, showing that many of them are surprisingly insensitive to changing the ring atom. (21 refs.)

70879 Matrix isolation infrared spectra of methylacetate. I. Monomer and dimer absorptions in argon. G.Maes (Dept. of Chem., Univ. of Leuven, Heverlee, Belgium).
Spectrosc. Lett. (USA), vol.16, no.4, p.311-24 (1983).
The infrared spectrum of methyl acetate is presented in argon matrices at 12K. An assignment of monomer and dimer absorptions is proposed. The ester molecules are believed to be H-bonded in the dimer system. (29 refs.)

Vibrational intensities in infrared and Raman spectroscopy .....See Entry 69802

Ab initio second-order Moller-Plesset calculations of the vibrational spectra of cyclobutadiene and its isotopic derivatives ....See Entry 70836

The $B(^2\Sigma^+)\rightarrow X(^2\Sigma^+)$ transition (4050-4500 Å) in HgI .... See Entry 70837

Condensed aromatics. XIX. Perylene ....See Entry 70843

Spectra of infrared transitions between highly excited states of polyatomic molecules ....See Entry 70845

Determination of A_0 and D_K for CD_3I from the ν_4 Raman and IR bands ....See Entry 70883

Vibrational spectra of bromocyclopropane .... See Entry 70885

Vibrational spectra and analysis of $Te_6{}^{4+}$, a trigonal-prismatic cluster cation ....See Entry 70889

The spectroscopy and single vibronic level fluorescence quantum yields of jet cooled trans-stilbene and its Van der Waals complexes .... See Entry 70938

Comments on the vibrational structure in dye's superexcitation spectra ....See Entry 70954

Relative intensities of *P*, *Q*, and *R* branches of ν_4 of SF_6 ....See Entry 70956

The dynamics of ethylene dimer infrared photodissociation in pulsed molecular beams ....See Entry 70971

Infrared-microwave two-photon spectra of the ν_3 bands of $^{12}CH_3F$ and $^{13}CH_3F$ ....See Entry 70974

Dunham coefficients for seven isotopic species of CO ....See Entry 70983

Observation of the $v=1\leftarrow0$ band of SH ($X^2\Pi$) with a difference frequency laser ....See Entry 71039

Problem of multiple lines in absorption bands in the infra-red spectra of urethanes and polyurethanes ....See Entry 71042

Spectral characteristics of carbon monoxide lasers with different isotopic compositions ....See Entry 71110

Doppler shift and ion mobility measurements of ArH^+ in a He DC glow discharge by infrared laser spectroscopy .... See Entry 71698

Photoacoustic and absorption spectra of UF_4 .... See Entry 72811

Sensitivity of ozone retrievals in limb-viewing experiments to errors in linewidth parameters .... See Entry 73885

N_2 broadening parameters of ozone at 9.6 μm .... See Entry 73887

The NH_3 spectrum in Saturn's 5 micron window .... See Entry 74034

33.20F Raman and Rayleigh spectra

(inc. scattering)

70880 Franck-Condon effect in resonance Raman scattering of TCNQ-radical. The excitation profiles of 336 cm^{-1} and 2192 cm^{-1} fundamentals. M.Pawlikowski (Inst. of Chem., Jagellonian Univ., Cracow, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.547-50 (April 1983).
Simple model based on the Franck-Condon principle is used to reproduce the absorption spectrum and excitation profiles of totally symmetric vibrations of TCNQ-radical. The excitation profiles of 336 cm^{-1} (C=C ring stretch+-C=C wing stretch) and 2192 cm^{-1} (C≡N stretch) fundamentals are quantitatively analyzed within $^2B_{3g}\rightarrow{}^2B_{1u}$ electronic absorption band. This analysis provides the estimation for the shifts in vibrational equilibrium position between $^2B_{3g}$ and $^2B_{1u}$ electronic states. (11 refs.)

70881 Spectroscopic studies of the v_2 mode of methyl iodide by Raman spectroscopy. F.G.Baglin, H.Versmold (Phys. Chem., Univ. of Dortmund, Dortmund, Germany).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.656-7 (29 April 1983).
Polarized Raman studies of the ν_2 mode in methyl iodide at 1 and 1600 bar have confirmed, through an independent route, the results previously found by isotopic-dilution studies. By using a cubic-close-packed approximation of the liquid state and a $1/r^6$ interaction potential for dipolar dephasing between molecules, the data may be reconciled. This result is interpreted to be strong evidence for the dominance of the intermolecular transition-dipole dephasing mechanism. (8 refs.)

70882 Jahn-Teller effect and resonance Raman spectra of highly spin-degenerate molecules with application to $FeBr_4{}^-$. M.T.Bourgeois, M.Jacon (Lab. de Recherches Optiques, Faculte des Sci. de Reims, Reims, France).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.107-13 (6 May 1983).
Gives a model calculation of the resonance Raman amplitude of spin-degenerate molecules that are subject to Jahn-Teller distortion. The method is applied to the resonance Raman excitation profiles of the $\nu_3(t_2)$ and $\nu_1(a_{1g})$ modes of $FeBr_4{}^-$. (11 refs.)

70883 Determination of A_0 and D_K for CD_3I from the ν_4 Raman and IR bands. C.Poulsen, S.Brodersen (Dept. of Chem., Univ. of Aarhus, Aarhus, Denmark).
J. Raman Spectrosc. (GB), vol.14, no.2, p.77-82 (April 1983).
The ν_4 Raman band of CD_3I has been recorded at a resolution of 0.28 cm^{-1}. A weighted least-squares analysis, including data from the ν_4 infrared band recorded by Peterson and Edwards (1971), gave $A_0=2.59608\pm0.00010$ cm^{-1} and $D_K=(1.98\pm0.10)\times10^{-5}$ cm^{-1} in addition to values for ν_0, $(A\zeta)_4$, ΔA and ΔB. The ν_4 state is essentially unperturbed. Using literature values for α^A constants, A_e was calculated as 2.6200 ± 0.0008 cm^{-1}, indicating a value of $r_e=1.03192\pm0.00015$ Å for the distance of the deuterium atoms from the figure axis. (23 refs.)

70884 Time-resolved resonance Raman study of transient benzooxazolinic merocyanines. J.L.Albert, J.Aubard, J.E.Dubois (Inst. de Topologie et de Dynamique des Systems, Univ. Paris VII, Paris, France).
J. Raman Spectrosc. (GB), vol.14, no.2, p.83-6 (April 1983).
The time-resolved resonance Raman spectrum (excitation: 532 nm, 30 ns laser pulse; optical multichannel detection) of the short-lived species generated by UV flash irradiation of a benzooxazolinic spiropyran in toluene or benzene, has been obtained. The CW resonance Raman spectrum of a related permanent benzooxazolinic merocyanine closely resembles the spectrum of the transient species. A tentative assignment of the Raman bands is proposed in order to characterize the bonds directly involved in the π-electron delocalization of the merocyanines. (13 refs.)

70885 Vibrational spectra of bromocyclopropane. C.J.Wurrey, R.J.Berry, Y.Y.Yeh (Dept. of Chem., Univ. of Missouri, Kansas City, MO, USA), T.S.Little, V.F.Kalasinsky.
J. Raman Spectrosc. (GB), vol.14, no.2, p.87-92 (April 1983).
Fourier transform infrared spectra of bromocyclopropane at a resolution of 0.5 cm^{-1} have been recorded as well as liquid phase infrared spectra of this molecule from 4000-400 cm^{-1}. For the first time, gas phase Raman spectra and solid phase infrared spectra of bromocyclopropane have been obtained. By combining all of the spectral data available it has been possible to assign all 21 normal modes of vibration of bromocyclopropane (as well as several overtones and combination bands) with a high degree of confidence. This proposed assignment is in excellent agreement with assignments for similar molecules and with anticipated cyclopropyl group frequencies. (13 refs.)

70886 Applications of four-channel Raman difference spectroscopy to studies in hydrogen-bonded systems. H.Takahashi, B.P.Asthana, W.Hafner, W.Kiefer (Phys. Inst., Univ. Bayreuth, Bayreuth, Germany).
J. Raman Spectrosc. (GB), vol.14, no.2, p.102-5 (April 1983).
The authors report on some potential applications and advantages of the four-channel Raman detection technique developed recently at their laboratory. The capability of recording four different Raman signals simultaneously and processing them electronically by scaling of each signal in order to obtain a desired linear combination, has been fully exploited. The simultaneous measurement of $I_\parallel$ and $I_\perp$ of the Raman spectra of pyridine and a mixture of pyridine+methanol, thus allows one to derive the isotropic Raman bandwidths of ν_1 and ν_{8b} vibrations in the hydrogen-bonded species $C_5H_5N...HOCH_3$ and at the same time very small frequency shifts of vibrations of the non hydrogen-bonded pyridine (in mixture) as compared to pure pyridine. The smallest shift that could be measured was 0.045 cm^{-1}. It has been demonstrated that four-channel Raman difference spectroscopy has a distinct advantage for studying the vibrations of complex systems such as a hydrogen-bonded species. (11 refs.)

70887 Coherent anti-Stokes Raman spectra of isoalloxazines. F.Muller, J.Vervoort, J.Lee, M.Horowitz, L.A.Carreira (Univ. of Georgia, Athens, GA, USA).
J. Raman Spectrosc. (GB), vol.14, no.2, p.106-17 (April 1983).
Coherent anti-Stokes Raman spectra (1700-1100 cm^{-1}) of 7,8-dimethyl-10-tetraacetylisoalloxazine (tetraacetylriboflavin) in chloroform and several other

solvents of higher polarity and proton availability are reported. Solvent polarity has no influence on either the intensities or frequencies of the Raman modes, whereas the influence of protic solvents is more marked. As well as altering the effective mass of the particular atoms in the isoalloxazine involved, hydrogen bonding is known to change the bond hybridization throughout the entire ring system. A similarly mild electronic perturbation can be produced by changing the methyl substitution on the benzene subnucleus of the isoalloxazine, and this is shown to produce significant changes in the Raman spectrum. Isotopic substitution with ^{13}C and ^{15}N is used to mimic the effective mass changes that would occur on hydrogen bonding. For the model compounds in chloroform, the effect of isotopic substitution on some modes is different from that reported for the same substitution in riboflavin bound to riboflavin binding protein. Frequencies of the prominent bands in all spectra were determined by lineshape analysis. On the basis of these results a tentative interpretation is made of the changes that occur in the Raman spectra of flavins when they bind to flavoproteins. (30 refs.)

70888 UV-excited resonance Raman spectra of methyl orange and its complex with cetyltrimethylammonium bromide. H.Lee, K.Machida (Faculty of Pharmaceutical Sci., Kyoto Univ., Kyoto, Japan), A.Kuwae, I.Harada.
J. Raman Spectrosc. (GB), vol.14, no.2, p.126-9 (April 1983).
Resonance Raman spectra of methyl orange and its ring-deuterated and ^{15}N-azo derivatives were measured with the excitation line at 350.7 nm of a Kr^+ laser, and the spectral changes on the complex formation between the dye and cetyltrimethylammonium bromide were studied. In the presence, as well as the absence, of the surfactant, the UV-excited resonance Raman spectrum of each isotope of methyl orange is appreciably different from the corresponding spectrum excited with the Ar^+ 488.0 nm line. The UV-excited spectrum of the pure aqueous solution of the dye is attributed to the non-hydrated monomeric species of the dye anion responsible for the absorption band around 420 nm. The spectral pattern between 1500 and 1300 cm^{-1} of the mixed solution of the dye and the surfactant changes in two steps on increase of the surfactant concentration in accordance with the change of the absorption spectrum in the UV-visible region due to the formation of micelles. The UV-excited resonance Raman spectra of acidic solutions of the isotopic methyl orange zwitterions were also measured. By combining the data relating to the effect of pH and the concentration of the surfactant, the N-N stretching frequency in the Raman spectrum was shown to be correlated closely with the π-π^* transition frequency in the absorption spectrum. (10 refs.)

70889 Vibrational spectra and analysis of Te_6^{4+}, a trigonal-prismatic cluster cation. R.C.Burns, R.J.Gillespie (Dept. of Chem., McMaster Univ., Hamilton, Ontario, Canada).
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.439-47 (1983).
Raman and infrared spectra have been recorded on a number of compounds of the Te_6^{4+} cation, and assignments have been made on the basis of a trigonal-prismatic geometry with D_{3h} symmetry. A vibrational analysis has been carried out using a modified valence force field, giving Te-Te stretching force constants of 1.13 and 0.93/0.64 mdyn $Å^{-1}$ for the two non-equivalent bonds of the trigonal prism. Comparisons are made with data for other species which have Te-Te bonds. The force constants for Te_6^{4+} are consistent with the bonding models that have been proposed for this species. (18 refs.)

Vibrational intensities in infrared and Raman spectroscopy .....See Entry 69802

CNDO/S calculations of resonance Raman spectra and pre-resonance excitation profiles of organic molecules ....See Entry 70777

Condensed aromatics. XIX. Perylene ....See Entry 70843

Infrared and Raman spectra of Ag(I) and Hg(II) complexes of 1-methylthymine ....See Entry 70859

Infrared and Raman orientation correlation functions of the ν_3 vibration of N_2O mixed with rare gases ....See Entry 70860

Interconversion studies and characterization of asymmetric and symmetric dinitrogen trioxide in nitric oxide matrices by Raman and infrared spectroscopy ....See Entry 70863

Vibrational spectroscopic studies on some 2-substituted 1,3-dithia-2-phospha- and 2-arsa-cyclopentanes ....See Entry 70878

Effects of underpotentially deposited Tl and Pb submonolayers on the surface-enhanced Raman scattering (SERS) from pyridine at Ag electrodes ....See Entry 72780

The enhancement of Raman scattering, resonance Raman scattering, and fluorescence from molecules adsorbed on a rough silver surface ..See Entry 72784

Magnetic electronic Raman optical activity of osmium (IV) hexabromide, iridium (IV) hexachloride and uranocene ....See Entry 72797

33.20K Visible spectra

70890 The electronic absorption spectrum of I-C≡C-C≡C-I^+ in a Ne matrix. S.Leutwyler, J.P.Maier, U.Spittel (Phys.-Chem. Inst., Univ. Basel, Basel, Switzerland).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.645-8 (29 April 1983).
The optical absorption spectrum of diiododiacetylene cation was obtained in a 4.5K Ne matrix in the wavelength range 2800-9000 Å. The $\tilde{A}^2\Pi_{3/2,u} \leftarrow \tilde{X}^2\Pi_{3/2,g}$ transition was observed and vibrationally analyzed. (13 refs.)

70891 Rotational analysis of the $^2B_1$ ($K'=0$)$\leftarrow$$^2A_1$ ($K''=1$) bands with $\nu_2'=6$, 7 and 10 in the excitation spectrum of NO_2. S.Takezawa (Gunma Univ., Showamachi, Gunma, Japan), N.Sugimoto, N.Takeuchi.
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.77-80 (6 May 1983).
The rotational structure of the $^2B_1$ state of NO_2 is analyzed by means of the time-gated excitation spectrum, monitored at the $^3\nu_2$ band. The band origins ν_0 and the rotational constants are evaluated from the observed data: $\nu_0=20204.86$ cm^{-1}, $\bar{B}'=0.374$ for $\nu'=6$; $\nu_0=21104.49$ cm^{-1}, $\bar{B}'=0.374$ cm^{-1} for $\nu'=7$, and $\nu_0=23791.36$ cm^{-1}, $\bar{B}'=0.361$ for $\nu'=10$. (7 refs.)

70892 Spectroscopy of naphthalene in simple molecular liquids. F.Li, J.Lee, E.R.Bernstein (Dept. of Chem., Colorado State Univ., Fort Collins, CO, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1175-80 (31 March 1983).
Optical spectra of the first excited singlet state ($1B_{3u}$) of naphthalene in cryogenic molecular hydrocarbon alkane and alkene liquids (CH_4, C_2H_4, C_2H_6, C_3H_6, C_3H_8, 1-C_4H_8) have been obtained and are discussed in terms of the solute-solvent intermolecular interaction. Data include gas-to-liquid shifts, Frank-Condon shifts, line widths for absorption and emission and their temperature dependences. Naphthalene line widths and their temperature dependences and Franck-Condon shifts are smaller than those found for benzene but the gas-to-liquid shifts for both systems are quite similar. Based on these results and the comparison with similar benzene data, the ground- and excited-state Lennard-Jones type potential curves for naphthalene-solvent interactions can be generated. The main conclusions are that naphthalene has a stronger interaction with the solvent than does benzene, the interaction scales with solvent polarizability, and the change in cavity radius upon excitation is greater for benzene than for naphthalene. Lifetime data have also been obtained for the naphthalene fluorescence. At low temperature, the liquid-state lifetime for fluorescence is roughly the same as that found in the low-pressure gas (~300 ns). A small temperature dependence is characterized for these low-concentration solutions leading to an activation energy for naphthalene collision-induced intersystem crossing of ~100 cm^{-1}. The excimer formation and monomer regeneration mechanism reported for benzene is also observed in naphthalene C_3H_6 and C_3H_8 solutions but it is of much less importance to the overall kinetics. (22 refs.)

70893 Spectroscopic studies of toluene in simple molecular liquids. J.Lee, F.Li, E.R.Bernstein (Dept. of Chem., Colorado State Univ., Fort Collins, CO, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1180-3 (31 March 1983).
Absorption and emission spectra and fluorescence lifetimes are reported for the $^1B_1$ state of toluene in a number of simple hydrocarbon solvents (CH_4, C_2H_6, C_3H_8, C_2H_4, C_3H_6, and 1-C_4H_8). Spectroscopic data such as gas-to-liquid shifts, intermolecular Franck-Condon shifts, line widths, and their temperature dependences can be employed to study potentials present in the cryogenic liquid near the equilibrium separation for solvent and solute. Lifetimes as a function of concentration and temperature indicate that toluene excimers do not form, apparently due to steric hindrance. The results for toluene are compared and contrasted to those of benzene. The intermolecular interactions are nearly identical for the two systems, suggesting that polarizabilities and not dipole moments are important for C_nH_m solvents and hydrocarbon probe systems. Toluene relaxation kinetics and their temperature dependences are discussed. (11 refs.)

70894 Visible and ultraviolet absorption spectrum of UCl_6 dissolved in liquid Xe. W.B.II.Maier, R.F.Holland, W.H.Beattie (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Spectrosc. Lett. (USA), vol.16, no.3, p.233-8 (1983).
The visible and ultraviolet absorption spectrum of UCl_6 dissolved in liquid xenon is measured. Some structure is observed, and the absorptions extend into the red. (9 refs.)

Calculations of medium effects on absorption and emission spectra by SCRF theory ....See Entry 70760

UV-excited resonance Raman spectra of methyl orange and its complex with cetyltrimethylammonium bromide ....See Entry 70888

Stark effect in azo compounds with long hydrocarbon tail ......See Entry 70929

Charge-transfer interactions with *N*-methylquinolinium ion as electron acceptor ....See Entry 73331

33.20L Ultraviolet spectra

70895 The UV spectrum of ^{18}OD. M.Nuss, K.-H.Gericke, F.J.Comes (Inst. fur Phys. und Theoretische Chem., Frankfurt, Germany), W.A.Guillory.
J. Mol. Spectrosc. (USA), vol.98, no.1, p.154-60 (March 1983).
The combined high-resolution ultraviolet (uv) absorption spectrum of ^{16}OD and ^{18}OD was obtained. State selective measurements of the transitions from the electronic ground state to the first excited electronic state, $\tilde{A}^2\Sigma^+ \leftarrow \tilde{X}^2\Pi$, in the 0-0 vibronic band were performed by means of a narrow bandwidth dye laser system. Evaluation of these transition frequencies in wave-numbers yielded molecular constants as well as rotational term values for each of the isotopic species. A computer program based on a linearized least-squares procedure was used to determine the molecular constants and term values. The term value formulas which were employed for this purpose, take into account the Λ splitting and the centrifugal distortion of the diatomic species. The transitions, recalculated from the semiempirically determined term values agree with the measured absorption lines to better than 0.1 cm^{-1}. The following molecular constants are reported: B, D, H, the rotational constants of the $^2\Pi$ and $^2\Sigma^+$ states; O_0, P_0, Q_0, the constants of the Λ splitting of the $^2\Pi$ state; A and A_j; the constants of the spin-orbit coupling of the $^2\Pi$ state; and γ_0, the constant of the ρ doubling of the $^2\Sigma^+$ state. Furthermore, term values up to J'' and J' of 25.5 and the corresponding UV transitions are given. (13 refs.)

70896 Extensive study of the $1_g(^3P_2)$ ion pair state of I_2. J.P.Perrot, M.Broyer, J.Chevaleyre, B.Femelat (Lab. de Spectrometrie Ionique et Moleculaire, Univ. Lyon, Villeurbanne, France).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.161-7 (March 1983).
Presents extensive spectroscopic study of the $1_g(^3P_2)$ ion pair state of I_2, recently observed and assigned. The results lead to a definitive vibrational numbering that changes by −2 the former v numbering by King et al. (Chem. Phys. 56, 145-156 (1981)). Greatly improved spectroscopic constants have been deduced for the $1_g(^3P_2)$ state as well as for the formerly best known $O_g^+(^3P_2)$ state. (19 refs.)

Calculations of medium effects on absorption and emission spectra by SCRF theory ....See Entry 70760

New spectroscopic proofs supporting the existence of a σ,π coupling between a benzenic chromophore and an α carbon atom without the need of hyperconjugative hydrogen atoms and symmetry elements ....See Entry 70769

The $B(^2\Sigma^+) \rightarrow X(^2\Sigma^+)$ transition (4050-4500 Å) in HgI ....See Entry 70837

UV-excited resonance Raman spectra of methyl orange and its complex with cetyltrimethylammonium bromide ....See Entry 70888

The electronic absorption spectrum of I-C≡C-C≡C-I^+ in a Ne matrix ....See Entry 70890

Visible and ultraviolet absorption spectrum of UCl_6 dissolved in liquid Xe ....See Entry 70894

Stark effect in azo compounds with long hydrocarbon tail ......See Entry 70929

Fluorescence yields from photodissociation of NH_3 and H_2O_2 ....See Entry 70944

Nitrogen-, oxygen-, and air-broadened widths and relative intensities of N_2O lines near 2450 cm^{-1} ....See Entry 70957

33.20N Vacuum ultraviolet spectra

70897 Spectroscopic investigation of the electronic structure of the chlorine molecule in the VUV. T.Moeller, B.Jordan, P.Gurtler, G.Zimmerer (II. Inst. fur Experimentalphys., Univ. Hamburg, Hamburg, Germany), D.Haaks, J.le Calve, M.-C.Castex.
Chem. Phys. (Netherlands), vol.76, no.2, p.295-306 (15 April 1983).
Vacuum ultraviolet absorption spectroscopy and fluorescence analysis under selective optical excitation have been combined to deduce the electronic structure of Cl_2. Between 73000 and 81000 cm^{-1} five bound electronic states could be analysed. Some of them are affected by pronounced Rydberg-valence mixing. Especially the $1^1\Sigma_u^+$ state clearly yields a double-well structure which results from an avoided crossing between an ionic valence and a Rydberg

state. The double-well structure is responsible for an irregular vibrational sequence between 73000 and 74500 cm^{-1} which either prevented an analysis in earlier investigations or lead to wrong assignments. The FC factors of the $1^1\Sigma_u{}^+$ fluorescence with its bound-bound and bound-free contributions between $\approx$73000 and 50000 cm^{-1} are also severely affected by the double-well structure. The results are compared with the first ab initio calculations of the electronic structure of Cl_2. In general, excellent agreement is found. (27 refs.)

70898 The vacuum ultraviolet absorption spectrum of SiO in rare gas matrices. J.Hormes, M.Sauer, R.Scullman (Phys. Inst., Univ. Bonn, Bonn, Germany).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.1-19 (March 1983).
The vacuum ultraviolet absorption spectrum of the SiO molecule in four rare gas matrices was investigated using the 2.5-GeV synchrotron in Bonn as a continuum light source. Three different vibrational progressions of bands are observed in the wavelength region 1050-2500 Å. They are interpreted as corresponding to bands of the $A^1\Pi$-$X^1\Sigma^+$, $E^1\Sigma^+$-$X^1\Sigma^+$, and $G^1\Pi$-$X^1\Sigma^+$ systems of gas phase SiO. Additional unclassified absorption lines may possibly originate from transitions from the ground state to Rydberg states. (25 refs.)

Oscillatory continuum emission from Br_2 following vacuum ultraviolet laser excitation ....See Entry 70934

33.20R X-ray spectra

70899 X-ray absorption spectra of water and ammonia molecules. V.N.Akimov, A.S.Vinoradov, T.M.Zimkina.
Opt. & Spectrosc. (USA), vol.53, no.3, p.280-2 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.476-9 (Sept. 1982). [received: May 1983]
The *K* absorption spectra of nitrogen and oxygen atoms in NH_3 and H_2O molecules were investigated with an instrumental resolution of ~0.2 and 0.5 eV. The fine structure of the spectra was identified as the result of electronic transitions to orbitals of the valence-Rydberg and Rydberg types by comparison with data on VUV spectra and with the results of theoretical calculations. Within the framework of the combined-atom model, the *K*-absorption spectra of isoelectronic series H_2O-NH_3-CH_4-Ne were compared, and a good correlation between the structures of these spectra was noted. The values 0.6 and 0.8 eV were, respectively, obtained in the NH_3 and H_2O molecules for the energy splitting value of the orbitals corresponding to the 3*p* orbitals of the Ne atom in the combined-atom model. (16 refs.)

33.25 NUCLEAR MAGNETIC RESONANCE AND RELAXATION; NUCLEAR QUADRUPOLE RESONANCE (NQR)

70900 Carbon-13 chemical shifts as a probe for conformational and electronic effects in alkyl vinyl ethers. J.G.K.Webb, D.K.Yung (Coll. of Pharmacy, Dalhousie Univ., Halifax, NS, Canada).
Can. J. Chem. (Canada), vol.61, no.3, p.488-93 (March 1983).
The principle of additivity of substituent chemical shifts (SCS) is applied to the carbon-13 chemical shifts of β carbons (δ_β) in a number of 1,1-disubstituted ethylenes and propenes, which includes some α-substituted alkyl vinyl ethers. An additivity relationship is observed for 34 compounds that indicates an independent polarization mechanism across the double bond for each geminal substituent. Positive deviations from additivity are observed for compounds bearing bulky substituents. The magnitude of deviations is taken as an indication of the severity of steric interactions among substituents. Reductions in efficiency of transmission of substituent effects in ring substituted α-phenyl alkyl vinyl ethers, relative to para-substituted styrenes, are interpreted as the result of a variable dihedral angle between the ring and vinyl group. An explanation of the relationship between conformation and transmission of substituent effects is presented as an alternative to existing views. An angular dependence of π-polarization and resonance effects is consistent with the chemical shift data. (38 refs.)

70901 ^{23}Na nuclear magnetic resonance linewidth studies of sodium tetraethylaluminate: complexes with hexamethylphosphoramide in benzene. J.H.Medley, E.S.Mooberry, M.C.Day (Dept. of Chem., Louisiana State Univ., Baton Rouge, LA, USA).
Can. J. Chem. (Canada), vol.61, no.3, p.558-61 (March 1983).
The linewidth of the ^{23}Na resonance in sodium tetraethylaluminate in benzene has been measured as a function of the ratio of [donor]:[Na^+] using the strong complexing agent hexamethylphosphoramide. In this system changes in the sodium linewidth arise primarily from changes in the nuclear quadrupole relaxation at the sodium nucleus which in turn arise from changes in the electric field gradient. As the ratio of hexamethylphosphoramide to sodium ion is increased up to 3:1 the ^{23}Na linewidth progressively decreases due to an increase in cation-anion distance in the ion pair. After a ratio of 4:1 is reached, essentially no linewidth change is noted, indicating a stable solvation number of 4 for hexamethylphosphoramide. The results of this study indicate that this is a new and promising approach to the determination of solvation numbers of the sodium ion. (29 refs.)

70902 On the structure of water NMR spectra in membranes. V.V.Mank, N.I.Lebovka (A.V. Dumanski Inst. of Colloid & Water Chem., Acad. of Sci., Kiev, Ukrainian SSR).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.626-30 (29 April 1983).
Proton magnetic resonance spectra of water in magnetically non-uniform heterogeneous systems is analysed. It is shown that the multiple structure of spectra for different heterogeneous objects, including membranes, may be determined by the effects of magnetic inhomogeneity providing the ordered distribution for water-filled pores of anisotropic form exists. (29 refs.)

70903 ^{13}C and ^{1}H NMR analysis of isotopically labeled Benzo[*a*]pyrenes. C.J.Unkefer, R.E.London, T.W.Whaley, G.H.Daub (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Am. Chem. Soc. (USA), vol.105, no.4, p.733-5 (23 Feb. 1983).
^{13}C AND ^{1}H NMR spectra of each of the 12 isotopomers of benzo[*a*]pyrene specifically labeled with carbon-13 at a methine position have been obtained. These studies lead to reassignment of 11 of the 20 ^{13}C resonances of benzo[*a*]pyrene, and to unambiguous ^{1}H assignments. $^1J_{CC}$ values were found to follow Hansen's rule, although the specific parameterization varied significantly depending on the source of the bond-length data. The optimum fit for the methine carbons was determined to be $^1J_{CC}=-143l+257$; for coupling between methine and quaternary carbons, $^1J_{CC}=-119l+227$. Vicinal couplings between ^{13}C atoms do not show a significant correlation with the bond order of the central bond in the vicinal coupling pathway; however, coupling between vicinal carbons which are trans along the periphery of the ring system (class I) have a mean of 5.45 Hz compared with the vicinal trans coupling through the ring (class II) with a mean of 3.06 Hz. (23 refs.)

70904 Chemical shift anisotropy and second-sphere hydrogen bonding in cobalt (III) complexes. S.C.F.Au-Yeung, D.R.Eaton (Dept. of Chem., McMaster Univ., Hamilton, Ontario, Canada).
J. Magn. Resonance (USA), vol.52, no.3, p.351-65 (May 1983).
The linewidths of the ^{59}Co NMR resonances of 22 Co(III) complexes were measured at fields of 2.114, 5.872, and 9.395 T. The linewidths for octahedral complexes show no field dependence. Less symmetric compounds show differences in linewidth of as much as 10 kHz between the highest field and the lowest field. The linewidth changes parallel the chemical shift anisotropies calculated from optical absorption spectral data. For complexes with high symmetry the increase in width is proportional to the square of the field strength. For complexes of lower symmetry, plots against field squared show a pronounced curvature. If the increase in linewidth is calculated from the chemical shift anisotropies obtained from optical data (or from single-crystal measurements reported in the literature) and correlation times derived from quadrupole coupling constants the calculated increases in width are more than two orders of magnitude smaller than the observed increases. Correlation times of the order 10^{-9} to 10^{-10} sec rather than the accepted 10^{-11} sec for rotational correlation times are required to fit the data. It is suggested that these long correlation times are associated with the lifetimes of hydrogen bonds with second-sphere solvent molecules. (44 refs.)

70905 The solvent and field dependence of ^{59}Co NMR linewidths. S.C.F.Au-Yeung, D.R.Eaton (Dept. of Chem., McMaster Univ., Hamilton, Ontario, Canada).
J. Magn. Resonance (USA), vol.52, no.3, p.366-73 (May 1983).
The chemical shifts and linewidths of the ^{59}Co resonances of six cobalt (III) complexes of low symmetry are discussed. Measurements at three different field strengths and in a variety of solvents are reported. Both the linewidths and their field dependence differ markedly in different solvents. The results are correlated with the hydrogen bonding abilities of the solvents. The field-independent part of the linewidth is attributed to quadrupolar relaxation and it is inferred that both the quadrupolar coupling constant and the correlation time vary with solvent. The field-dependent contribution is substantial in strongly hydrogen bonding solvents and small in weakly hydrogen bonding solvents indicating that the field dependence of ^{59}Co relaxation times is associated with second coordination sphere interactions. (15 refs.)

70906 ^{13}C isotope effects on the parameters of proton magnetic resonance spectra of benzene. V.A.Chertkov, N.M.Sergeyev (Dept. of Chem., Moscow State Univ., Moscow, USSR).
J. Magn. Resonance (USA), vol.52, no.3, p.400-6 (May 1983).
The proton-coupled ^{13}C NMR spectra and the ^{13}C satellites in the ^{1}H NMR spectra of commercial benzene containing about 6.6% of benzene-1-^{13}C were measured and analyzed using the iterative LACX program; 271 lines were assigned and used in the calculations (105 lines from the proton-coupled ^{13}C NMR spectra, 118 lines from outer satellites, and 48 lines from inner satellites in the ^{1}H NMR spectra). The exact values of the ^{13}C-^{1}H coupling constants were obtained with the standard deviations not exceeding 0.004 Hz. The ^{12}C/^{13}C-induced proton isotope chemical shifts were found to be $^1\Delta=2.44$; $^2\Delta=1.34$; $^3\Delta=0.51$; and $^4\Delta=0.33$ (in parts per billion). The ^{12}C/^{13}C- induced isotope effects on the proton-proton coupling constants do not exceed 0.005 Hz. (17 refs.)

70907 A numerical calculation of the NMR lineshape using the finite difference method. J.I.Kaplan, K.V.Vasavada (Dept. of Phys., Indiana Purdue Univ., Indianapolis, IN, USA).
J. Magn. Resonance (USA), vol.52, no.3, p.475-9 (May 1983).
A procedure is given for calculating the NMR lineshape of a cluster of spins imbedded in a molecule which is rotating with free or restricted motion. It is shown that for the isotropic diffusion model (assuming a correlation time τ_c such that $1/\tau_c \gg H_{DD}/\hbar$ where H_{DD} is the dipole interaction) the line shape is Lorentzian as expected and has a width equal to that obtained from a standard T_2 calculation using the appropriate autocorrelation function. For τ_c which do not satisfy this condition the lineshape is no longer Lorentzian, and an example for this condition is shown. The usefulness of the procedure lies in obtaining lineshapes for systems whose motion is too complex for an autocorrelation function to be obtained unambiguously. (9 refs.)

70908 Carbon-13 spin-lattice relaxation mechanisms for the t-butyl cation in superacid. Importance of chemical shift anisotropy to the relaxation of cationic carbons. D.P.Kelly, D.R.Leslie (Dept. of Organic Chem., Univ. of Melbourne, Parkville, Victoria, Australia), R.A.Craig.
J. Magn. Resonance (USA), vol.52, no.3, p.480-91 (May 1983).
The contributions to the spin-lattice relaxation rates of the methyl and cationic carbons of the t-butyl carbocation in superacid were determined from the observed T_1 values at 213K and different field strengths. Chemical shift anisotropy (CSA) contributes 20% to the relaxation rate of the cationic carbon at 14.1 kG and 80% at 58.8 kG. The large contribution from CSA is due both to the shielding anisotropy (450 ppm) and to $\tau_{eff}{}^{CSA} > \tau_{eff}{}^{DD}$. This anisotropy is larger than observed previously in neutral molecules. Most of the remaining contribution is due to intramolecular C-H dipole-dipole interactions as no spin-rotation contribution was detected. The spin-rotation mechanism also makes no contribution to the relaxation of the methyl carbons, which is dominated by similar dipole-dipole interactions. Application of the Woessner equations (1969) to this anisotropically reorienting species provides the ratio of the diffusion constants $\rho=D_\parallel/D_\perp$ but not the internal methyl diffusion coefficient D_i. The calculated ratio is sensitive to methyl group geometry and it is concluded that the C^+-C-H angle is closer to 113 than 109.47°. (45 refs.)

70909 Effects of cross relaxation on the analysis of T_1 data in paramagnetic proteins. E.Sletten, J.T.Jackson, P.D.Burns, G.N.La Mar (Dept. of Chem., Univ. of California, Davis, CA, USA).
J. Magn. Resonance (USA), vol.52, no.3, p.492-6 (May 1983).
Several paramagnetic proteins with molecular weights in the range 10000-20000 are presently being studied by ^{1}H NMR. Semilogarithmic T_1 plots for all these proteins exhibit pronounced curvature for at least several of the resonances. The authors have been studying the Gd^{3+}-induced paramagnetic relaxation of the low spin ($S=1/2$) horse heart ferricytochrome *c* (cyto. *c*). Specific Gd^{3+} binding to the protein results in differential broadening of various resonances. These hyperfine shifted resonances arise from the assigned heme, axial methionine, as well as some as yet unassigned probable amino acid protons. Analysis of this Gd^{3+}-induced dipolar relaxation, which varies as the inverse sixth power of the distance to the Gd^{3+}, using the assigned resonances is expected to define a binding site, which in turn can be used to assign new resonances. While the binding site is not yet defined, the studies have produced some interesting observations relevant to the interpretation of such data. (13 refs.)

70910 Variation of NMR chemical shifts induced by $[Fe(CN)_6]^{3-}$. Zhong-Xian Huang, G.R.Moore (Inorganic Chem. Lab., Oxford, England).
J. Magn. Resonance (USA), vol.52, no.3, p.505-10 (May 1983).
Paramagnetic ions are widely used to perturb NMR spectra either to simplify them or to provide specific chemical and biochemical information. One such reagent that has become increasingly important in this respect is $[Fe(CN_6)]^{3-}$. $[Fe(CN)_6]^{3-}$ is a low-spin d^5 ion ($S={}^1/_2$) that causes perturbations to resonance chemical shifts without appreciably affecting linewidths and as a result it has been used extensively to simplify spectra to study ion-pair formation in solution and in a solid, and as a structural probe to obtain conformational parameters. The mechanism of the shift was investigated by the study of ^1H NMR spectra of a variety of aliphatic amines and the quarternary aromatic amine methylviologen (also known as paraquat), and from a study of ^{13}CNMR spectra of trimethyllysine. (22 refs.)

70911 ^{13}C spin-echo modulation through ^{13}C, ^2H spin-spin coupling: elimination of solvent signals and analysis of partially deuterated systems. P.Schmitt, J.R.Wesener, H.Gunther (Fachbereich 8, Univ. of Siegen, Siegen, Germany).
J. Magn. Resonance (USA), vol.52, no.3, p.511-14 (May 1983).
J modulation of spin-echo signals has become a well-known technique, and applications reach from signal assignments in ^{13}C NMR spectroscopy to *J*-resolved two-dimensional ^{13}C spectra. The authors describe a straight-forward extension to deuterated molecules, where they use scalar ^{13}C, ^2H spin-spin coupling to modulate transverse ^{13}C magnetization. These experiments require ^2H decoupling and, for example, a ^{19}F lock channel, since additional ^1H decoupling is desirable in most cases for various reasons (sensitivity enhancement, simplified spectra). Practical applications are the elimination of ^{13}C NMR signals from deuterated solvents and the ^{13}C NMR analysis of mixtures of partially deuterated systems. (7 refs.)

70912 Analytic solution of fourth degree secular equations: $I=3/2$ Zeeman-quadrupole interactions and $I=7/2$ pure quadrupole interaction. R.B.Creel (Dept. of Phys., Univ. of Akron, Akron, OH, USA).
J. Magn. Resonance (USA), vol.52, no.3, p.515-17 (May 1983).
An analytic solution is presented for any fourth degree secular equation arising from a traceless spin Hamiltonian. The energy levels are derived as functions of the interaction parameters. The solutions are applied to two specific Hamiltonians which generate quartic secular equations; the $I={}^3/_2$ combined Zeeman-quadrupole interactions and the $I={}^7/_2$ pure quadrupole interaction. (7 refs.)

70913 Multipulse techniques to edit ^{13} NMR spectra of deuterated compounds. Useful methods to follow deuterium in biosynthesis. D.M.Doddrell, J.Staunton, E.D.Laue (Univ. Chem. Labs., Univ. of Cambridge, Cambridge, England).
J. Magn. Resonance (USA), vol.52, no.3, p.523-8 (May 1983).
A variety of one-dimensional multipulse techniques have been developed recently to edit ^{13}C NMR spectra into nonprotonated, CH, CH_2, and CH_3 subspectra. These methods rely on controlled precession via the one-bond CH scalar coupling (J_{CH}) and the relative constancy of these values in a complex molecule. However, spin-echo techniques are relatively sensitive to variation in J_{CH} (2,3) when compared with polarization-transfer methods such as DEPT. The authors consider some of the possible spin-echo methods likely to be useful to edit ^{13}C spectra based on one-bond ^{13}C-^2H scalar coupling. These methods are likely to be extremely useful in following the fate of deuterium atoms in biosynthetic and reaction mechanism studies, which involve a high dilution of the deuterium label. (9 refs.)

70914 Proton and carbon-13 nuclear magnetic resonance spectra and INDO study of serotonine, tryptamine and L-tryptophan. S.Biagini, A.Lai, M.Monduzzi, G.Saba (Istituto Chimica Fisica e Industriale, Univ. di Cagliari, Cagliari, Italy).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.491-6 (April 1983).
An NMR investigation on serotonine, tryptamine and L-tryptophan in aqueous solution is reported. Homonuclear proton coupling constants are compared with those calculated at an INDO level and the results are discussed in terms of different conformations. A deuterium substitution study on serotonine provided information on the couplings of indole and aliphatic protons. Deuterium incorporation rates are shown to correlate with π INDO excess charges. (17 refs.)

70915 Positive temperature coefficient of the iodine quadrupole resonance frequency in ammonium tri-iodide due to reorientation of the ammonium ion. Y.Yoshioka, N.Nakamura, H.Chihara (Dept. of Chemistry, Osaka Univ., Osaka, Japan).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.497-504 (April 1983).
A large increase in the nuclear quadrupole resonance (NQR) frequency of a terminal iodine atom I_a of the I_3 anion in NH_4I_3 is explained by a simple theory which relates the reorientation of the ammonium ion to a concerted change in the relative weights of the resonance structures of the I_3 anion through formation and scission of the N-H...I_a hydrogen bond. The weight of the structure (I_a^- I-I) oscillates between 0.75 (hydrogen-bonded) and 0.48 (non-bonded) as the NH_4 cation is reoriented. The proton spin-lattice relaxation time was measured between 77 and 240 K; a minimum of 2.45 ms occurs at 80K. The activation energy for ammonium reorientation is 7.53 kJ mol^{-1}. The energy of a hydrogen bond, including the effect of the change in relative weights of I_3, was derived as 5.20 kJ mol^{-1}. (12 refs.)

70916 Pressure dependence of ^1H and ^{19}F chemical shifts in 1,1-difluoroethylene gas and in gaseous mixtures. S.K.Singh (Dept. of Phys., Ravenshaw Coll., Cuttack, India), S.Mohanty.
Mol. Phys. (GB), vol.48, no.6, p.1383-7 (20 April 1983).
The authors have measured the chemical shifts, δ, and 'second virial shielding coefficient', σ_1, for gaseous 1,1-difluoroethylene and its mixture with other gases at varying pressures (~10-45 atmospheres). The δ vs. ρ (density) plot for ^1H and ^{19}F resonances is found to be linear within the pressure range studied. The sign of σ_1 is negative. The influence of perturbers on δ and σ_1 is in the following order: $Xe>SF_6>Kr>SiF_4>CH_4>CF_4$ (spherical top molecules) and $C_2H_6>C_2H_4>HCl>CO_2$ (nonspherical top molecules). These trends are true for polar and nonpolar solutes. (13 refs.)

70917 ^1H NMR and ^{13}C NMR spectra of B-aminothiosulphonic derivatives related to pseudonorthioephedrine. B.Kone, M.Gelbcke (Lab. de Chimie Pharmaceutique Organique et de Bromatologie, Univ. Libre de Bruxelles, Bruxelles, Belgium).
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.409-13 (1983). In French.
A series of β-aminothiosulfonic acids related to nor- and pseudonorthioephedrine (N-CH_3; N-C_2H_5; N-iC_3H_7 acid N-t C_4H_9) has been synthesized. The study of their ^1H-NMR and ^{13}C-NMR spectra allowed the differentiation of them. The substitution by a tertiary butyl group give rise to important modifications and produce an unexpected γ deshielding effect. (32 refs.)

70918 Study of a steric interaction effect in the benzofuran series. J.Belleney, J.Vebrel (Lab. de Chimie Appliquee, Univ. de Franche-Comte, Besancon, France), N.Platzer, F.Theobald.
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.429-38 (1983). In French.
The synthesis of dimethoxypoxycarbonyl-2,3 benzofuran, of its four monomethyl derivatives and of some di- and tri-methyl derivatives allowed the authors to perform their structural analysis by ^{13}C NMR and mass spectrometry. These studies showed the importance of electronic and steric interactions in these compounds. The special properties of the dimethoxycarbonyl-2,3 methyl-4 benzofuran leads one to determine its crystalline structure. (18 refs.)

70919 Carbon-13 nuclear magnetic resonance studies of aspergillomarasmine A anhydroaspergillomarasmine B and of aspergillomarasmine A Ca^{+2} chelate. M.Barbier (CNRS, Gif-sur-Yvette, France).
Spectrosc. Lett. (USA), vol.16, no.4, p.255-65 (1983).
Carbon-13 NMR determinations have been carried out on aspergillomarasmine A, anhydroaspergillomarasmine B, isolated from different species of fungi and comparisons allow the attribution of the signals to all carbon atoms. Changes observed in the spectrum by forming the 1:1 chelate of aspergillomarasmine A and the fact that aspergillomarasmine B cannot give chelates, lead to a proposal for the structure of this complex. (8 refs.)

Cross polarization magic-angle spinning NMR at cryogenic temperatures ....See Entry 70092

New spectroscopic proofs supporting the existence of a σ,π coupling between a benzenic chromophore and an α carbon atom without the need of hyperconjugative hydrogen atoms and symmetry elements .... See Entry 70769

Multipole NMR. III. Multiplet spin theory .... See Entry 72685

33.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

70920 Experimental and theoretical study on cation radicals of cyclopropane, cyclobutane and cyclopentane. K.Ohta, H.Nakatsuji (Dept. of Hydrocarbon Chem., Kyoto Univ., Kyoto, Japan), H.Kubodera, T.Shida.
Chem. Phys. (Netherlands), vol.76, no.2, p.271-81 (15 April 1983).
Cation radicals of cycloalkanes have been produced for the first time in γ-irradiated rigid solutions using fluoromethane as a matrix. Observed ESR spectra are analyzed by ab initio MO calculations; molecular geometries of the cations are optimized for several low-lying doublet states by the energy gradient method. Based on the optimized geometry thus determined the hyperfine splitting constants are calculated by the pseudo-orbital theory. Large Jahn-Teller distortions are calculated for the carbon rings and the H-C-H frames of the cation radicals. The distortions are consistent with the nodal picture of singly occupied orbitals. The calculated HFS constants are sensitive to the change in geometry due to a large contribution of spin-delocalization. The average of the calculated proton HFS constants is compatible with the observed ESR spectra which indicates that all the protons of the individual cations have become equivalent owing to the dynamic Jahn-Teller distortion. (28 refs.)

70921 Electron spin resonance studies of radical cations of five-membered heteroaromatics. Furan, thiophene, pyrrole, and related compounds. M.Shiotani, Y.Nagata, M.Tasaki, J.Sohma (Faculty of Engng., Hokkaido Univ., Sapporo, Japan).
J. Phys. Chem. (USA), vol.87, no.7, p.1170-4 (31 March 1983).
Radical cations of several five-membered heteroaromatics (furan, thiophene, pyrrole, 2-methylfuran, 2-methylthiophene, 3-methylthiophene, and 2,5-dimethylfuran) have been detected and identified by ESR studies on solid solutions of the parent molecules in various fluorinated matrices. The matrices used include CCl_3F, SF_6, c-C_6F_{12}, c-$C_6F_{11}CH_3$, and c-C_4F_8. The spin density distribution obtained by the ESR analysis suggests that the unpaired electron resides in the π orbital of $1a_2$ nature for all the radical cations studied. This is consistent with the photoelectron spectra of the parent molecules and with the INDO calculation for the respective cations. Using c-$C_6F_{11}CF_3$ as matrix, we observed well-resolved ESR spectra for 2-methylfuran, 2-methylthiophene, 3-methylthiophene, and 2,5-dimethlyfuran cation radicals. The effect of CH_3 substitution on the spin distribution is discussed. Furthermore, bimolecular reactions between a radical cation and a neutral molecule of furan in a matrix were briefly discussed. (42 refs.)

70922 Metal-nitroxyl interactions. XXIX. EPR studies of spin-labeled copper complexes in frozen solution. S.S.Eaton (Dept. of Chem., Univ. of Colorado, Denver, CO, USA), K.M.More, B.M.Sawant, P.M.Boymel, G.R.Eaton.
J. Magn. Resonance (USA), vol.52, no.3, p.435-49 (May 1983).
Frozen solution EPR spectra have been obtained for 12 spin-labeled copper complexes. A perturbation calculation including both exchange and dipolar interaction was used to simulate the spectra. The distances between the two spins ranged from 7.5 to 13.5 Å. The absolute value of the electron-electron exchange coupling constant ranged from 0 to about 2000×10^{-4} cm^{-1}. (24 refs.)

Simulation of electron spin resonance spectra by fast Fourier transform ....See Entry 72657

33.35 DOUBLE RESONANCES AND OTHER MULTIPLE RESONANCES

70923 Triplet emission from furil in different crystalline environments: optical and ODMR studies. C.J.Sandroff, I.Y.Chan (Dept. of Chem., Brandeis Univ., Waltham, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.60-5 (6 May 1983).
The excited triplet state of furil was examined in single crystals of 4,4'-dibromodiphenyl ether and benzophenone. Phosphorescence and ODMR spectra reveal several distinct emitting species. In both crystals at low temperatures furil is probably trans-planar. In benzophenone at elevated temperatures two emitting furil species transfer energy on a 100 μs time scale. (8 refs.)

70924 The hyperfine structure of akaline-earth monohalide radicals: new methods and new results 1980-1982. W.J.Childs (Argonne Nat. Lab., Argonne, IL, USA).
Comments At. & Mol. Phys. (GB), vol.13, no.1, p.37-50 (1983).
The first observation of the hyperfine structure of a fully isolated alkaline-earth monohalide radical was published in 1980. This review summarizes the various approaches used since then, and outlines the present status of knowledge. Particular attention is given to the contributions of the molecular-beam, laser-RF, double-resonance technique. Sophisticated ab initio calculations are needed for comparison with the large body of high quality data now at hand. (24 refs.)

70925 Transient effects in homonuclear double resonance. G.Tomlinson (IBM Instruments Inc., Danbury, CT, USA).
J. Magn. Resonance (USA), vol.52, no.3, p.374-85 (May 1983).
The effect of transient excitation on homonuclear double resonance spectra of spin 1/2 nuclei is investigated. An analysis is given which accurately describes the experimental results presented. The signal received at the irradiation frequency is experimentally verified to be due to a spin transition and not due to 'decoupler breakthrough'. Stationary states calculated by combining spin and quantized radiation states in the laboratory reference frame are used to facilitate the transition probability calculation. (9 refs.)

70926 Comparison of decoupling and spatial randomization methods for use in editing ^{13}C spectra. M.R.Bendall, D.T.Pegg, D.M.Doddrell (School of Sci., Griffith Univ., Nathan, Queensland, Australia).
J. Magn. Resonance (USA), vol.52, no.3, p.407-23 (May 1983).
Two known spin randomization techniques, which might be used for separating a methylene (CH_2)/quarternary (q) ^{13}C subspectrum into separate CH_2 and q subspectra, are compared. Both techniques utilise the heteronuclear scalar coupling interaction between the carbon and directly bonded proton spins. However, the first technique involves randomization of the ^{13}C spins in the transverse plane of the rotating reference frame as a result of off-resonance ^1H decoupling, whereas the second technique involves randomization of the ^1H spins in three dimensions by a powerful noise-modulated pulse. The latter method is superior in that it is much less sensitive to the nonequivalence of methylene protons. (21 refs.)

70927 Assignment of ^{13}C resonances and ^{13}C, X spin-spin coupling constants via double-quantum coherence. P.Schmitt, H.Gunther (Fachbereich 8, Univ. of Siegen, Siegen, Germany).
J. Magn. Resonance (USA), vol.52, no.3, p.497-9 (May 1983).
The observation of ^{13}C, ^{13}C spin-spin coupling constants in natural abundance is greatly facilitated through the use of the INADEQUATE pulse technique, which allows a suppression of the S_0 magnetization from molecules with only one isolated ^{13}C. The original pulse sequence (1) $90°(x)$-τ-$180°(y)$-τ-$90°(x)$-Δ-$90°(\phi)$, FID contains a very short delay Δ (10 μsec) needed for resetting the radiofrequency pulse. The authors show that Δ can be used to advantage as an additional evolution period t_1' that allows one to select a particular double-quantum coherence which arises during the first part of the INADEQUATE sequence. (5 refs.)

Excitation and relaxation of the ν_3 vibration of the OsO_4 molecule in a low-temperature xenon matrix ....See Entry 70875

Extensive study of the $1_g(^3P_2)$ ion pair state of I_2 ....See Entry 70896

^{13}C spin-echo modulation through ^{13}C, ^2H spin-spin coupling: elimination of solvent signals and analysis of partially deuterated systems ....See Entry 70911

Rotational energy transfer in HF (ν=2): double resonance measurements and fitting law analysis ....See Entry 70999

33.45 MAGNETO-OPTICAL AND ELECTRO-OPTICAL SPECTRA; DICHROISM

70928 Electrostatic solvent effect on the circular dichroism of the carbonyl $n \to \pi^*$ transition. M.F.Ruiz-Lopez, D.Rinaldi (Lab. de Chimie Theorique, CNRS, Vandoeuvre-les-Nancy, France).
THEOCHEM (Netherlands), vol.10, p.277-81 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The rotatory strength of the $n \to \pi^*$ transition in a simple chiral molecule containing a carbonyl group is computed by means of the CNDO/S technique with the use of configuration interaction. A method is proposed to study the modification by a solvent of both position and intensity of the CD spectrum. The calculations allow to separate solvent effects on the electronic distribution and the nuclear geometry. A detailed analysis of the influence of electronic polarization and geometry perturbations induced by the solvent on the CD spectrum is given. In addition, a reversal of the relative stabilities of some conformers in solution is predicted. (14 refs.)

Electronic spectra of biphenylene and diazabiphenylenes ....See Entry 70846

33.45B Zeeman and Stark effects

70929 Stark effect in azo compounds with long hydrocarbon tail. L.M.Blinov, V.T.Lazareva, S.G.Yudin.
Opt. & Spectrosc. (USA), vol.53, no.3, p.272-6 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.462-8 (Sept. 1982). [received: May 1983]
Spectra of the optical density and the quadratic Stark effect were measured in the 250-420-nm region for azo compounds that have donor [a long hydrocarbon tail $CH_3(CH_2)_{17}O$] and acceptor ($CN, NO_2, COOH$) groups. The differences in the dipole moments $\Delta\mu$ between the ground state and its closest excited state of molecules as well as the corresponding differences in electrical polarizabilities $\Delta\alpha$ are calculated from experimental data. The results are of interest for determination of the degree of orientation of molecules of such compounds in multilayers from measurements of the linear Stark effect. (14 refs.)

Determination of the dipole moment of nitrosyl fluoride in the (001) and (101) states by combination of microwave and laser Stark data ....See Entry 70849

Analytic solution of fourth degree secular equations: $I=3/2$ Zeeman-quadrupole interactions and $I=7/2$ pure quadrupole interaction ....See Entry 70912

Calculated ro-vibrational fine-structure spectrum and weak-field Zeeman splittings of the O_2Ar van der Waals molecule ....See Entry 70979

33.45C Magnetic circular dichroism

70930 Magnetic circular dichroism studies. LXII. Sign variation in the magnetic circular dichroism spectra of some perimeter symmetric free-base porphyrins. J.D.Keegan, E.Bunnenberg, C.Djerassi (Dept. of Chem., Stanford Univ., Stanford, CA, USA).
Spectrosc. Lett. (USA), vol.16, no.4, p.275-86 (1983).
For pt.LXI see J. Am. Chem. Soc., vol.104, no.16, p.4317 (1982). The MCD bands associated with the four lowest energy electronic transitions of perimeter symmetric porphyrin free-bases have commonly exhibited the 'normal' sign pattern of $-+-+$ in the order of increasing energy. The first known exceptions to this rule, found in a series of tetrakis(o,o'-dihalophenyl)porphyrins, are presented. The sign inversions in the Q bands as well as the normal sign pattern in the Soret bands (overall pattern: $+--+$) can be understood on the basis of Michl's perimeter model (1978). (22 refs.)

Electronic spectra of biphenylene and diazabiphenylenes ....See Entry 70846

33.50 FLUORESCENCE, PHOSPHORESCENCE; RADIATIONLESS TRANSITIONS (INTERSYSTEM CROSSING, INTERNAL CONVERSION)

70931 Influence of the energy transfer between excited molecules on delayed luminescence decay in rigid luminophors. F.Burak (Inst. of Phys., Tech. Univ., Gdansk, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.519-29 (April 1983).
An analysis of the kinetics of the processes deactivating singlet states (S) and triplet states (T) in the luminophor emitting phosphorescence (P) and thermally activated delayed fluorescence (EDF) has been carried out. Among the processes causing the deactivation of excited molecules, apart from the monomolecular processes, the action of an intermolecular process of singlet-triplet (S-T) energy transfer has been regarded. The obtained rate of delayed luminescence decay as a function of emitted luminescence intensity has been applied for the description of the experimental rates of delayed luminescence decay of fluoresceine solutions in boric acid glass. (18 refs.)

70932 Rotationally resolved photofragment alignment and the vacuum ultraviolet photodissociation of H_2O. J.P.Simons, A.J.Smith (Dept. of Chem., Univ. of Nottingham, Nottingham, England).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.1-3 (6 May 1983).
The photodissociation of H_2O in the vacuum UV ($\lambda<135$ nm) generates rotationally aligned populations of $OH(A^2\Sigma^+)$ fragments. Measurements of their rotationally resolved fluorescence polarisation following photolysis at 130.4 nm reinforces the suggestion that the vibrational structure in the $\tilde{B}^1A_1 \leftarrow \tilde{X}^1A_1$ continuum is associated with long-lived 'resonances' in the excited state. The low levels of alignment at 121.6 nm reflect a delay in the radiationless transfer out of the quasi-bound $\tilde{D}^1A_1$ Rydberg state initially populated. (16 refs.)

70933 Delayed fluorescence $S_2 \to S_0$ from 4,6,8-trimethylazulene due to homo-triplet-triplet annihilation. D.Klemp, B.Nickel (Abteilung Spektroskopie, Max-Planck-Inst. fur Biophys. Chem., Gottingen, Germany).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.66-71 (6 May 1983).
A delayed fluorescence $S_2 \to S_0$ from the second excited singlet state (S_2) of 4,6,8-trimethylazulene (TMA), resulting from homo-triplet-triplet annihilation $T_1+T_1 \sim\to S_2+S_0$, has been observed. No delayed fluorescence from an upper excimer state of TMA was found. The extrapolated low-temperature triplet lifetime of TMA is $\approx$140 μs. (23 refs.)

70934 Oscillatory continuum emission from Br_2 following vacuum ultraviolet laser excitation. M.MacDonald, R.J.Donovan (Dept. of Chem., Univ. of Edinburgh, Edinburgh, Scotland), M.C.Gower.
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.72-6 (6 May 1983).
Laser-induced fluorescence from Br_2 following excitation at 158 nm (F_2 laser) is reported. The most intense emission features are associated with three bound-free transitions (oscillatory continua) in the region 210-440 nm. Efficient collisional interstate transfer, by SF_6, N_2 and He, is observed and the possibility of constructing an optically pumped Br_2 laser is noted. (12 refs.)

70935 Phosphorescence of *s*-triazine vapor. N.Ohta, M.Fujita, T.Takemura, Y.Shindo, H.Baba (Div. of Chem., Hokkaido Univ., Sapporo, Japan).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.81-4 (6 May 1983).
The phosphorescence of *s*-triazine vapor has been observed by means of time-resolved emission spectroscopy. The phosphorescence spectrum is diffuse with a faint vibronic structure in the shorter-wavelength region. The phosphorescence quantum yield is 3.0×10^{-5} for excitation at the 6_0^2 absorption band of the $S_0 \to S_1$ transition, and the lifetime is 7.1×10^{-6} s. (17 refs.)

70936 Singlet energy transfer from the charge-transfer excited state of tris(2,2'-bipyridine)ruthenium(II) to laser dyes. K.Mandal, T.D.L.Pearson, W.P.Krug, J.N.Demas (Dept. of Chem., Univ. of Virginia, Charlottesville, VA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.4, p.701-7 (23 Feb. 1983).
Efficient singlet energy transfer from the charge-transfer (CT) excited state of $[Ru(bpy)_3]^{2+}$ (bpy=2,2'-bipyridine) to several laser dyes has been demonstrated. The limiting efficiencies of dye singlet state formation are 1.00 which shows the efficiency of formation of the sensitizing state of $[Ru(bpy)_3]^{2+}$ is unity. For most of the dyes in methanol, energy transfer is shown to be predominantly by diffusion-assisted Forster transfer. For Rhodamine 101, however, energy transfer is predominantly by a contact exchange transfer. This result shows that the CT state of the sensitizer has a great deal of singlet character and should be referred to as a spin-orbit state. (31 refs.)

70937 Emission and laser excitation spectra of rotationally cooled cations: $A\sim{}^2\Pi_u \leftrightarrows X\sim{}^2\Pi_g$ band systems of $X(C{\equiv}C)_2X^+$, X=Cl,Br. D.Klapstein, J.P.Maier, L.Misev (Phys.-Chem. Inst., Univ. Basel, Basel, Switzerland).
J. Chem. Phys. (USA), vol.78, no.9, p.5393-402 (1 May 1983).
The $\tilde{A}^2\Pi_{\Omega,u} \leftrightarrows X\sim{}^2\Pi_{\Omega,g}$, $\Omega=3/2$, 1/2, electronic transitions of rotationally and vibrationally cooled dichlorodiacetylene and dibromodiacetylene cations in the gas phase have been studied by emission and laser excitation spectroscopies. The emission spectra were obtained by electron impact excitation of the molecules seeded in a supersonic helium free jet and the excitation spectra by laser-excited fluorescence of cations cooled to liquid nitrogen temperature. The narrowing of the vibronic bands in the spectra allow the vibrational frequencies for these cations in the $\tilde{X}^2\Pi_{\Omega,g}$ and $\tilde{A}^2\Pi_{\Omega,u}$ states to be inferred to within 1-2 cm^{-1}. Complementary use of both sets of data enable the spin-orbit components to be unambiguously identified and many spectral features to be interpreted. The vibrational frequency trends are also discussed. (11 refs.)

70938 The spectroscopy and single vibronic level fluorescence quantum yields of jet cooled trans-stilbene and its Van der Waals complexes. T.S.Zwier, E.Carrasquillo M., D.H.Levy (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5493-505 (1 May 1983).
This paper reports results on the spectroscopy and dynamics of trans-stilbene seeded in a supersonic free jet. The cooling provided by the expansion results in well-resolved vibronic structure near the origin. Fluorescence excitation spectra reveal two low frequency vibrational modes at 82 and 95 cm^{-1} above the origin. By 1800 cm^{-1} above the origin the discrete vibronic structure has given way to a continuous absorption which extends to 6200 cm^{-1} blue of the origin. The fluorescence excitation spectrum is combined with a direct absorption measurement in the jet using a Xe lamp in order to obtain SVL fluorescence quantum yields for the isolated trans-stilbene molecule. The fluorescence quantum yields show no mode dependence, indicating that vibrational relaxation within the trans configuration is much faster than isomerization to the perpendicular configuration. Stilbene van der Waals complexes with helium and argon have been identified in fluorescence excitation spectra at higher nozzle backing pressures. Dispersed fluorescence spectra of these complexes place an upper bound on the stilbene-He binding energy in the excited state of 82 cm^{-1}. Several features of the photodissociation of these complexes are discussed. (20 refs.)

70939 Excited-state dynamics of 3-hydroxyflavone. A.J.G.Strandord, S.H.Courtney, D.M.Friedrich, P.F.Barbara (Dept. of Chem., Univ. of Minnesota, Minneapolis, MN, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1125-33 (31 March 1983).
The authors have investigated the time- and wavelength-resolved fluorescence spectroscopy of 3-hydroxyflavone (3HF) in several solvents and find that the photodynamics are well described by a kinetic model that includes two pathways for excited-state intramolecular proton transfer (ESIPT). They are unable, at present, to identify a single dominant effect that controls the ESIPT kinetics in all solvents. Their data reveal an irreversible excited-state isomerization that occurs at a rate which is temperature and solvent dependent. This rate is exceptionally small (10^8-$10^{11}s^{-1}$) as compared to the published unresolvably rapid kinetics ($>10^{11}$ s^{-1}) observed for the other ESIPT molecules studied to date. In the paper they describe in detail the fluorescence kinetics of 3HF and propose some preliminary mechanistic interpretations of these data. (27 refs.)

70940 Excited-state intramolecular proton transfer and vibrational relaxation in 2-(2-hydroxyphenyl)benzothiazole. K.Ding, S.J.Courtney, A.J.Strandjord, S.Flom, D.Friedrich, P.F.Barbara (Dept. of Chem., Univ. of Minnesota, Minneapolis, MN, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1184-8 (31 March 1983).
The time and wavelength-resolved electronic fluorescence of 2-(2-hydroxyphenyl)benzothiazole in argon at 12K has been investigated under high-resolution conditions. The 475-nm emission band is produced <10 ps after optical excitation and exhibits rapid band-shape evolution. No emission is observed at <450 nm. The implication of these results on the understanding of the mechanism for excited-state intramolecular proton transfer of this molecule is discussed. (16 refs.)

70941 Time-resolved fluorescence spectra of rotationally cooled NO_2. W.R.Ferrell, C.H.Chen, M.G.Payne (Chem. Phys. Section, Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Phys. B (GB), vol.16, no.10, p.1721-32 (28 May 1983).
A tunable, pulsed dye laser was used to selectively excite rotationally cooled NO_2. Excitation fluorescence spectra, as well as wavelength-resolved fluorescence spectra, are presented. The radiative decay modes for various transitions are determined by examining the temporal dependence of the wavelength-resolved fluorescence lines. Single exponential decays were observed. (18 refs.)

70942 Experimental lifetimes, Lande factors and relaxation rates in $^{130}Te_2$. M.Ya.Tamanis.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.13-21 (1983). In Russian.
Spontaneous lifetimes for the (ν',J′) levels of the $A0_u{}^+$ and $B0_u{}^+$ states of $^{130}Te_2$ have been measured by means of laser-excited time-resolved fluorescence. The Hanle effect of $A0_u{}^+$, $B0_u{}^+$ and $X0_g{}^+$ states was studied. Using measured lifetimes the Lande factors from Hanle contours have been obtained. Relaxation cross sections in collisions with Te_2, Xe and He are presented. (13 refs.)

70943 Simultaneous transitions in light-scattering spectra induced by collisions between molecules. M.O.Bulanin, A.P.Kouzov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.266-9 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.450-6 (Sept. 1982). [received: May 1983]
Within the framework of the dipole-induced-dipole model with the assistance of an irreducible-spherical tensor formalism, the polarizability induced under binary interactions of anisotropic molecules was calculated. It was shown that the contribution to induced polarizability, which is proportional to the product of anisotropies $\gamma_a\gamma_b$, determines the possibility of simultaneous rotational excitation for a pair of molecules *ab* under light scattering. Measurements of contours for simultaneous-transition bands are promising from the standpoint of the study of the internal dynamics of condensed systems. An estimation for liquid hydrogen demonstrates that the intensity of the effect is sufficiently high to be detected experimentally. (24 refs.)

70944 Fluorescence yields from photodissociation of NH_3 and H_2O_2. M.Suto, L.C.Lee (Dept. of Electrical & Computer Engng., San Diego State Univ., San Diego, CA, USA).
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.50-1
The photoabsorption cross sections and photoemission cross sections of NH_3 were measured in the 1060-2000 Å region. The fluorescence from photofragment of NH_3 was measured by a PMT sensitive in the 1900-8000 Å region. The fluorescence cross sections were determined by calibrating the fluorescence intensities against the $OH(A^2\Sigma^+ \rightarrow X^2\Pi_i)$ emission from photodissociation of H_2O, for which the cross section is known. The absorption cross sections and photoemission cross sections of H_2O_2 were measured in the 1060-1900 Å region. (no refs.)

Picosecond spectrochronography ....See Entry 70124

CNDO/S calculations of resonance Raman spectra and pre-resonance excitation profiles of organic molecules ....See Entry 70777

Fluorescence excitation of CO in comets ....See Entry 70848

Spectroscopy of naphthalene in simple molecular liquids .... See Entry 70892

Spectroscopic studies of toluene in simple molecular liquids ....See Entry 70893

Spectroscopic investigation of the electronic structure of the chlorine molecule in the VUV ....See Entry 70897

Triplet emission from furil in different crystalline environments: optical and ODMR studies ....See Entry 70923

Pyrene quenching in a fluorescence, photoacoustic, and two-photon photoionization cell ....See Entry 70964

The $\bar{A}^1B_2$-$\bar{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,3-difluorobenzene ....See Entry 70975

Rate constants for vibrational energy transfer between CO ($\nu=1$) and CH_4 and substituted methane molecules in the temperature range 300 to 80K ....See Entry 70994

Excimer laser photolysis studies of translational-to-vibrational energy transfer in collisions of H and D atoms with CO ....See Entry 70995

The enhancement of Raman scattering, resonance Raman scattering, and fluorescence from molecules adsorbed on a rough silver surface ..See Entry 72784

The state-selective reactions of vibrationally excited $CH(X^2\Pi)$ with oxygen and nitrogen ....See Entry 73325

Rotational excitation in the carbon monoxide product of ketene photodissociation ....See Entry 73355

33.65 PHOTOELECTRON SPECTRA

70945 The first band in the He(I) photoelectron spectrum of the CH_2Cl free radical. L.Andrews, J.M.Dyke, N.Jonathan, N.Keddar, A.Morris, A.Ridha (Dept. of Chem., Univ. Southampton, Southampton, England).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.89-93 (6 May 1983).
The fluorine atom reaction with CH_3Cl provides the CH_2Cl free radical for observation of a structured photoelectron band at 8.88±0.01 eV vertical ionization energy with 1020±40 cm^{-1} vibrational intervals. This spacing is appropriate for the C-Cl fundamental in CH_2Cl^+ based on increase (p-p)π bonding in the cation as compared to the free radical. (33 refs.)

70946 Photoelectron spectra of 1,2,3-triazine and its methyl derivatives. R.Gleiter, J.Spanget-Larsen, R.Bartetzko (Inst. fur Organische Chem., Univ. Heidelberg, Heidelberg, Germany), H.Neunhoeffer, M.Clausen.
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.94-7 (6 May 1983).
The He(Iα) photoelectron (PE) spectra of 1,2,3-triazabenzene and its five mono-, di-, and tri-methyl derivatives are reported. The PE bands are assigned by comparison with the results of molecular orbital (MO) calculations and empirical correlation procedures. (10 refs.)

70947 Laser photoelectron spectroscopy of MnH^- and FeH^-: electronic structures of the metal hydrides, identification of a low-spin excited state of MnH, and evidence for a low-spin ground state of FeH. A.E.Stevens, G.S.Feigerle, W.C.Lineberger (Dept. of Chem., Univ. of Colorado, Boulder, CO, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5420-31 (1 May 1983).
The laser photoelectron spectra of MnH^- and MnD^-, and FeH^- and FeD^- are reported. A qualitative description of the electronic structure of the low-spin and high-spin states of the metal hydrides is developed, and used to interpret the spectra. A diagonal transition in the photodetachment to the known high-spin, $^7\Sigma^+$, ground state of MnH is observed. An intense off-diagonal transition to a state of MnH, at 1725±50 cm^{-1} excitation energy, is attributed to loss of an antibonding electron from MnH^-, to yield a low-spin quintet state of MnH. For FeH^- the photodetachment to the ground state is an off-diagonal transition, attributed to loss of the antibonding electron from FeH^-, to yield a low-spin quartet ground state of FeH. A diagonal transition results in an FeH state at 1945±55 cm^{-1}; this state of FeH is assigned as the lowest-lying high-spin sextet state of FeH. An additional excited state of MnH and two other excited states of FeH are observed. Excitation energies for all the states are reported; vibrational frequencies and bond lengths for the ions and several states of the neutrals are also determined from the spectra. The electron affinity of MnH is found to be 0.869±0.010 eV; and the electron affinity of FeH is determined to be 0.934±0.011 eV. Spectroscopic constants for the various deuterides are also reported. (47 refs.)

70948 Extra-atomic relaxation in HCl, ClF, and Cl_2 from X-ray photoelectron spectroscopy. K.D.Bomben, J.K.Gimzewski, T.D.Thomas (Dept. of Chem., Oregon State Univ., Corvallis, OR, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5437-42 (1 May 1983).
Application of the Manne-Aberg sum rule to the full photoelectron spectrum of core-ionized HCl, ClF, and Cl_2 gives relative extra-atomic relaxation energy for these molecules. The values obtained are in excellent agreement with those determined from the Auger parameter. These measurements together with the core ionization energies confirm that ClF is $Cl^{\delta+}F^{\delta-}$ rather than $Cl^{\delta-}F^{\delta+}$, as had been suggested by measurements of the molecular Zeeman effect. (41 refs.)

70949 Photoelectron spectra of the lanthanide trihalides and their interpretation. B.Ruscic, G.L.Goodman, J.Berkowitz (Argonne Nat. Lab., Argonne, IL, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5443-67 (1 May 1983).
The He I photoelectron spectra of gaseous $LaCl_3$, $LaBr_3$, LaI_3, $CeBr_3$, CeI_3, $NdBr_3$, NdI_3, ErI_3, $LuBr_3$, and LuI_3 have been obtained. They display a pronounced increase in splitting, and hence a progressively clearer definition of peaks in the valence band as either the halogen or the lanthanide increases in atomic number. These experimental features, together with a refined relativistic $X\alpha$ DVM calculation using the von Barth-Hedin potential, have enabled the authors to assign these peaks with confidence. The He II photoelectron spectra of $CeBr_3$, $NdBr_3$, and LuI_3 are also presented. They reveal that the 4*f*-like ionizations of early lanthanide members (e.g. Ce) occur at lower energy than the ligand valence band, but that those of late members (e.g. Lu) are corelike. The aforementioned calculations reproduce this behavior quantitatively. They also help to rationalize a bimodal behavior in the valence band; the spectra with less than half-filled 4*f* shell are very similar, as are those with more than half-filled 4*f* shell, but the two groups are distinctly different. The width of the valence bands, which varies over a factor 2.5, is correctly reproduced. The calculations have been extended to include fluorides, where contact is made with electron impact mass spectrometry and X-ray photoelectron spectra of solids, thereby enabling corrections to be made to the latter. The fragmentation behavior in mass spectrometry is then related to the states observed in photoelectron spectroscopy. Both the calculations and these experimental comparisons yield a picture in which the lanthanide fluorides display predominantly ionic bonding (Ln^{22+}); the bonding takes on successively more covalent character as one proceeds to chlorides ($Ln^{1.6+}$), bromides ($Ln^{1.3+}$), and iodides ($Ln^{1.0+}$). (34 refs.)

70950 A photoelectron spectroscopic study of (3+1) resonant multiphoton ionization of NO and NH_3. Y.Achiba, K.Sato, K.Shobatake, K.Kimura (Inst. for Molecular Sci., Okazaki, Japan).
J. Chem. Phys. (USA), vol.78, no.9, p.5474-9 (1 May 1983).
In the present work, the authors have measured energy spectra and angular distributions of photoelectrons emitted by three-photon resonant four-photon ionization of NO and NH_3 in the gas phase. The following conclusions have been obtained: (1) Ionization of NO through the Rydberg *F* and *H*(*H*′) states at $\nu'=0$ and 1 gives rise to the ground-state ion with $\nu=0$ and 1, respectively, by a $\Delta\nu=0$ transition; (2) Ionization of NH_3 through the Rydberg *C*′ states with $\nu'=0$-5 gives rise to the ground-state ion with $\nu=0$-5, respectively, by $\Delta\nu=0$ transitions; (3) Photoelectron angular distributions obtained for the (3+1) processes may well be interpreted in terms of cosine-square distributions. This fact strongly indicates that the ionization step takes place by one-photon direct ionization from the three-photon resonant states. (31 refs.)

70951 The HeI excited electron spectrum of phosphine—an experimental and theoretical study. R.Maripuu, I.Reineck, H.Agren, Wu Nian-Zu, Ji Ming Rong, H.Veenhuizen, S.H.Al-Shamma, L.Karlsson, K.Siegbahn (Inst. of Phys., Uppsala Univ., Uppsala, Sweden).
Mol. Phys. (GB), vol.48, no.6, p.1255-67 (20 April 1983).
The HeI excited electron spectrum of phosphine (PH_3) has been recorded with high resolution. The $^2A_1$ band reveals an extensive vibrational progression in the ν_2 bending mode with irregular structure at the low binding energy side due to hindered inversion. The existence of a barrier in the $PH_3{}^{+2}A_1$ ionic state has been confirmed by vibrational energy level and Franck-Condon factor calculations based on CASSCF calculations of the total energy. The

equilibrium angle between a P-H bond and the plane of the three hydrogen atoms in this ionic state was determined to be 15.5° and the barrier against inversion to be 160 meV. The adiabatic electron binding energy of this transition ($\tilde{X}^2A_1 \leftarrow X^1A_1$) was found to be 9.868±0.005 eV. (26 refs.)

70952 Angle-resolved photoelectron spectroscopy of organic π orbitals. P.R.Keller, M.N.Piancastelli, J.W.Taylor (Univ. of Wisconsin, Madison, WI, USA), T.A.Carlson, F.A.Grimm.

Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.29-30

A systematic gas phase study of π orbitals in a wide variety of organic molecules was accomplished using angle-resolved photoelectron spectroscopy. Angular distribution measurements were carried out as a function of photon energy in the 10 to 30 eV range. The angular distribution parameter, β, exhibited a dependence upon energy which was very similar for all the π orbitals investigated. Typically, the β value was found to be low near threshold, but it increased rapidly in the first 10 to 15 eV above threshold and then began to level off at electron energies higher than 10 or 15 eV. (7 refs.)

70953 Observation of a new Rydberg series of CO in the 450 Å region. C.Y.R.Wu, D.L.Judge (Dept. of Phys. & Space Sci. Center, Univ. of Southern California, Los Angeles, CA, USA).

Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.58

Using synchrotron radiation as a continuous background, the absorption spectrum of CO in the 380-470 Å region was obtained using a double ionization chamber. A Rydberg series in the 450 Å (27.5 eV) region has been observed to converge to the $F^2\Pi$ state, a two-electron excited state of CO. The series limit determined at 28.11 eV is in excellent agreement with the vertical ionization potential of the $F^2\Pi$ state measured by high resolution photoelectron spectroscopy. (no refs.)

An examination of adsorbed oxygen molecules on Ag(110) by UPS .... See Entry 72222

Ionization potentials of 1:1 alternating copolymers containing a pendant carbazolyl group as determined by UV photoelectron spectroscopy .... See Entry 72945

33.70 INTENSITIES AND SHAPES OF MOLECULAR SPECTRAL LINES AND BANDS

70954 Comments on the vibrational structure in dye's superexcitation spectra. P.P.Kircheva.

Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.74-8 (1983).

During the last two years new experiments carried out with the purpose of elucidating the nature of the absorption edge structure in dye superexcitation spectra have been reported in the literature. These experiments suggest a treatment of the absorption as apparent since it appears between two emission lines with long wavelength tails. Spectra in which the absorption cannot be assumed to be apparent are reported here. Two of the assumptions existing thus far in the literature have been discerned as most probable for the explanation of this 'non-apparent' structure. Experimental data have been used to show that the spectral change, observed in the new experiments, about the lines is obtained if the line intensity is not sufficiently high. The pumping at intensities considerably exceeding the threshold ones so as to obtain the scattering components is a condition for the occurrence of the spectral change. (12 refs.)

70955 The radiative lifetime of the $A^1\Pi$ state of CH^+ calculated from long CAS SCF expansions. M.Larsson (Res. Inst. of Phys., Stockholm, Sweden), P.E.M.Siegbahn.

Chem. Phys. (Netherlands), vol.76, no.2, p.175-84 (15 April 1983).

A theoretical study of the $A^1\Pi$-$X^1\Sigma^+$ transition of CH^+ is presented. Radiative lifetimes (τ) for the A state and the $f_{v'v''}$(A-X) oscillator strengths are calculated, using long mutually non-orthogonal CAS SCF expansions. The convergence of these properties is studied with respect to the size of the active orbital space and the basis set. Very large active spaces and basis sets are needed for obtaining reliably convergent results. The best calculated value for $\tau(v'=0)$ of 850 ns and for f_{00} of 5.45×10^{-3} are in good agreement with the results from the most recent experimental investigation, 815±25 ns and $(5.66 \pm 0.20) \times 10^{-3}$ respectively. In the calculation use has been made of experimental excitation energies and potential curves. Compared to the previously most accepted lifetime the present theoretical and the recent experimental values demand an increase of the interstellar CH^+ abundance. (32 refs.)

70956 Relative intensities of *P*, *Q*, and *R* branches of ν_4 of SF_6. S.Chin, W.B.Person (Dept. of Chem., Univ. of Florida, Gainesville, FL, USA).

J. Mol. Spectrosc. (USA), vol.98, no.1, p.258-61 (March 1983).

The authors measure the IR intensities of the branches in the FSF bending mode in ν_4 of SF_6, since the Coriolis effect is expected to be largest for that mode. The experiment consists of carefully recording the absorbance vs. wavenumber for a sample of SF_6 at known pressure and pathlength, and then measuring the integrated intensity in each branch of the absorption band. In initial attempts to do this, the authors measured the spectrum at low pressures and at high resolution (0.06 cm^{-1}) to obtain a spectrum showing resolved rotational lines (actually clusters of lines). This intensity measurement was not very reproducible and was difficult to make accurately, so they adopted the technique of pressure-broadening to smooth out the structure from individual lines to give a smooth band contour. (11 refs.)

70957 Nitrogen-, oxygen-, and air-broadened widths and relative intensities of N_2O lines near 2450 cm^{-1}. R.L.Hawkins, J.H.Shaw (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).

J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.543-8 (June 1983).

Spectra of the $\nu_1+2\nu_2$ and the weak underlying $\nu_1+3\nu_2-\nu_2$ band of N_2O near 2450 cm^{-1} have been analyzed by the nonlinear, least-squares, whole-band technique. The oxygen-, nitrogen-, and air-broadened line widths and the relative line intensities were determined. The air-broadened widths, for $|m|>3$, are in agreement with those in the 1980 AFGL line listing and the relative band intensities also agree, within about 20%, with the values in this listing. (21 refs.)

70958 Influence of solvents on the relaxation times of polymethine dyes in the picosecond range. B.F.Bareika, R.V.Danelyus, G.A.Dikchyus, G.G.Dyadyusha, A.A.Ishchenko, M.A.Kudinova, A.P.C.Piskarskas, V.A.Sirutkaitis, A.I.Tolmachev (V. Kapsukas State Univ., Vilnius, Lithuanian SSR).

Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1485-9 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2289-95 (Nov. 1982). [received: May 1983]

An investigation was made of the dependence of the relaxation time τ of the excited states of fourteen polymethine dyes with an absorption maximum near 1.06 μ on the nature of the solvent. The measurements were made by the direct method of picosecond flash photosecond flash photolysis. It was established that a choice of a suitable solvent could alter the value of the relaxation time τ by a factor of 1.5-5. A study of the dyes in various solvents made it possible to select materials for passive switches with relaxation times in the range from 2 to 130 psec. (17 refs.)

Introduction to atomic and molecular collisions .... See Entry 69801

CNDO/S calculations of resonance Raman spectra and pre-resonance excitation profiles of organic molecules .... See Entry 70777

Ab initio second-order Moller-Plesset calculations of the vibrational spectra of cyclobutadiene and its isotopic derivatives .... See Entry 70836

The $B(^2\Sigma^+) \rightarrow X(^2\Sigma^+)$ transition (4050-4500 Å) in HgI .... See Entry 70837

Coiolis intensity perturbations of the ν_4 band of SF_6 .... See Entry 70838

***r*-centroids and Franck-Condon factors for the *b′-X* and *b′-b* band systems of the NO^+ molecule** .... See Entry 70839

Spectra of infrared transitions between highly excited states of polyatomic molecules .... See Entry 70845

Microwave spectral study of cyclopentyl acetylene .... See Entry 70853

IR bandshapes of weakly H-bonded systems. II. Complexes of methyl-phenol derivatives with dioxane .... See Entry 70856

Line strength measurements using diode lasers: the ν_2 band of H_2S .... See Entry 70871

Franck-Condon effect in resonance Raman scattering of TCNQ- radical. The excitation profiles of 336 cm^{-1} and 2192 cm^{-1} fundamentals .... See Entry 70880

Spectroscopy of naphthalene in simple molecular liquids .... See Entry 70892

Spectroscopic studies of toluene in simple molecular liquids .... See Entry 70893

Extensive study of the $1_g(^3P_2)$ ion pair state of I_2 .... See Entry 70896

Spectroscopic investigation of the electronic structure of the chlorine molecule in the VUV .... See Entry 70897

Delayed fluorescence $S_2 \rightarrow S_0$ from 4,6,8-trimethylazulene due to homo-triplet-triplet annihilation .... See Entry 70933

Phosphorescence of *s*-triazine vapor .... See Entry 70935

Experimental lifetimes, Lande factors and relaxation rates in $^{130}Te_2$ .... See Entry 70942

The HeI excited electron spectrum of phosphine—an experimental and theoretical study .... See Entry 70951

The dynamics of ethylene dimer infrared photodissociation in pulsed molecular beams .... See Entry 70971

Effects of two-quantum processes on vibrational energy transfer in atom-diatom collinear collisions .... See Entry 70993

A relation between Holstein's photon escape transmission factor and the equivalent width .... See Entry 71687

Binary theory of dephasing in liquid solutions. I. The non-Markovian theory of encounters .... See Entry 71849

Binary theory of dephasing in liquid solutions. II. Motion-transformed isotropic Raman spectra .... See Entry 71850

Sensitivity of ozone retrievals in limb-viewing experiments to errors in line-width parameters .... See Entry 73885

N_2 broadening parameters of ozone at 9.6 μm .... See Entry 73887

Spectral line parameters for the pure rotation bands of solar OH .... See Entry 74064

33.80 PHOTON INTERACTIONS WITH MOLECULES

70959 The temperature dependence of the Cotton-Mouton effect of ethane, ethene and ethyne. H.Kling, H.Geschka, W.Huttner (Abteiling Chem. Phys., Univ. Ulm, Ulm, Germany).

Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.631-5 (29 April 1983).

The magnetic-field-induced birefringence of the three gases ethane, ethene, and ethyne has been measured between −80 and +120°C, at pressures up to 1 bar. The molar Cotton-Mouton constants depend linearly on the reciprocal absolute temperature which is in agreement with the well-known theory for non-interacting molecules. Magnetic hyperpolarizability anisotropy parameters, susceptibility anisotropies, and some secondary quantities of these molecules have been determined for the first time. (19 refs.)

70960 On the interaction operator in the optical spectroscopies with spin. D.Lee, A.C.Albrecht (Dept. of Chem., Cornell Univ., Ithaca, NY, USA).

J. Chem. Phys. (USA), vol.78, no.9, p.5374-8 (1 May 1983).

Recently the formalism describing the interaction of light with matter has been examined by Yang (1982) from the point of view of gauge invariance. Here this subject is discussed at the electric-dipole approximation for spin 'forbidden' optical transitions between molecular eigenstates. It is shown how the 'position' form of the interaction operator is the correct form, just as in the case of the spin-free spectroscopies. Furthermore, direct (allowed) optical transition between states with different spin angular momenta is possible (even at the electric-dipole approximation to the field), through the interaction of the spin magnetic moments with the magnetic field that is generated by the orbital motion of the electrons within the sinusoidally varying electric field of the incident light. However, the magnitude of its contribution to a spin forbidden transition is at the level of the direct magnetic-dipole transition between pure spin states; it can be expected to be relatively weak for systems containing atoms from the second period and beyond where the usual spin-orbit coupling mechanisms dominate in making spin forbidden transitions allowed. Cross terms between transition amplitudes from different mechanisms are found to vanish after appropriate orientational averaging. Spin forbidden transitions in benzene are reexamined in detail. (28 refs.)

33.80B Level crossing and optical pumping

Experimental lifetimes, Lande factors and relaxation rates in $^{130}Te_2$ .... See Entry 70942

Comments on the vibrational structure in dye's superexcitation spectra .... See Entry 70954

Influence of solvents on the relaxation times of polymethine dyes in the picosecond range .... See Entry 70958

33.80E Autoionization, photoionization, and photodetachment

70961 Molecular beam photoionization study of H_2S. H.F.Prest, W.-B.Tzeng, J.M.Brom,Jr., C.Y.Ng (US DOE, Iowa State Univ., Ames, IA, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.315-29 (15 May 1983).
Photoionization efficiency data for H_2S^+, S^+ and HS^+ have been obtained in the region 645-1190 Å using the molecular beam method. The ionization energy of H_2S was determined to be 10.4607 ± 0.0026 eV (1185.25 ± 0.30 Å). The observed autoionizing vibrational progressions are tentatively assigned to the Rydberg transitions: $5a_1 \rightarrow nsa_1$ ($n=5$ and 6) and $2b_2 \rightarrow nda_1$ ($n=4$ and 5). (39 refs.)

70962 Dissociation of benzylamine ions following infrared multiple photon absorption, electron impact ionization, and UV multiphoton ionization. J.H.Catanzarite, Y.Haas, H.Reisler, C.Wittig (Dept. of Electrical Engng. Phys. & Chem., Univ. of Southern California, Los Angeles, CA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5506-12 (1 May 1983).
The dissociation of benzylamine ions following (i) electron impact (EI) ionization, (ii) multiphoton ionization (MPI) at 266 nm, and (iii) infrared multiple photon absorption (IRMPA) at 9.26 μm is reported. In the EI and MPI experiments, three competitive dissociation pathways are observed. In the IRMPA experiments, benzylamine ions prepared by MPI at low fluences are fragmented very efficiently following irradiation with the focused output from a pulsed CO_2 laser. However, in contrast to the EI and MPI results, the IRMPD experiments reveal only a single, lowest energy, dissociation pathway and the fragmentation pattern is consistent with a sequential mechanism in which daughter ions continue to absorb the IR radiation and dissociate. The differences are explained by the different natures of the excitation processes: in IRMPA, the relatively slow up-pumping rate and the long rise time of the CO_2 laser pulse restrict the levels of excitation in the dissociating parent ions and favor sequential processes along the lowest energy decomposition pathways. (34 refs.)

70963 Laser photodissociation of Na_2^+ ions produced by laser resonant and non-resonant ionisation of Na vapour. F.Roussel, B.Carre, P.Breger, G.Spiess (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
J. Phys. B (GB), vol.16, no.10, p.1749-65 (28 May 1983).
The authors report direct measurements of the photodissociation of Na_2^+ ions created when a Na vapour in the density range 10^{12}-10^{13} cm^{-3} is irradiated by a pulsed laser with intensities in the 10^5-10^6 W cm^{-2} range. The Na_2^+ ions, accelerated by a weak electric field, are photodissociated in a second laser beam tuned to 6040 Å. In a preliminary experiment the Na_2^+ ions are formed in the lowest vibrational levels and the measured photodissociation cross section is compared with existing calculations. When the Na vapour is irradiated at one of the $3S_{1/2}$-$3P_{1/2,3/2}$ resonances the photodissociation measurements show the existence of a distribution of rovibrational excited levels of the Na_2^+ ions. A discussion is given in terms of associative ionisation in collisions of two Na(3p) atoms. The origin of the Na^+ ions produced simultaneously with the Na_2^+ ions, in the vapour irradiated at resonance, is also discussed. (25 refs.)

70964 Pyrene quenching in a fluorescence, photoacoustic, and two-photon photoionization cell. E.Voigtman, J.D.Winefordner (Chem. Dept., Univ. of Florida, Gainesville, FL, USA).
Spectrosc. Lett. (USA), vol.16, no.4, p.287-97 (1983).
A nitrogen laser-excited windowless flow cell has been used to examine the effects of various quenching agents (CH_3NO_2, CCl_4, and CH_3CH_2I) on the fluorescence (FL), photoacoustic effect (PA), and two-photon photoionization (2PI) of pyrene in ethanol. The results show that both the lowest excited singlet state (S_1) and the lowest triplet (T_0) are involved as real intermediate states in the consecutive two-photon photoionization of pyrene. (20 refs.)

Laser photoelectron spectroscopy of MnH^- and FeH^-: electronic structures of the metal hydrides, identification of a low-spin excited state of MnH, and evidence for a low-spin ground state of FeH ....See Entry 70947

33.80G Diffuse spectra; predissociation, photodissociation

70965 Photodissociation and predissociation in strong electromagnetic field: distortion of the continuum. A.Lami, N.K.Rahman (Istituto di Chimica Quantistica ed Energetica Molecolare, CNR, Pisa, Italy).
THEOCHEM (Netherlands), vol.10, p.295-8 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Continuum can be distorted by a strong external electromagnetic field. It is shown how such distortion can be induced by utilizing molecules in a generalized double resonance experiment. Some of the recent results are stressed and the role of theoretical chemistry in studying such phenomena is pointed out. (9 refs.)

70966 Weak Van der Waals complexes of the X...BC type: calculation of linewidths of metastable levels. M.Aguado, J.Salgado, C.Serrano (Facultad de Ciencias, Univ. Autonoma de Madrid, Madrid, Spain), P.Mareca, P.Villarreal, G.Delgado-Barrio.
THEOCHEM (Netherlands), vol.10, p.325-8 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The authors have applied a three-dimensional quantum model, very close to that of Beswick et al. (1980), to study the dynamics of vibrational predissociation (VP) of the He...I_2^* Van der Waals molecule near the dissociation limit of the I_2 subunit. The half-linewidth for vibrational predissociation Γ as a function of the vibrational excitation of I_2 exhibits a maximum about $v_{I2}=57$ in agreement with the experimental behaviour found by Sharfin et al. (1981). (8 refs.)

70967 Dissociation dynamics in high-energy molecule-surface collisions: the dissociation rainbow effect. R.Elber, R.B.Gerber (Dept. of Phys. Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.4-8 (6 May 1983).
Molecular dissociation in collisions with chemically inert surfaces is studied by classical trajectories. Calculated scattering intensities show striking features. For softly repulsive molecule-surface interactions, fragment angular distribution has a strong nonspecular peak (new rainbow effect), the velocity distribution exhibits two maxima. Multiple-collision mechanisms conveniently interpret the results. (17 refs.)

70968 Photodissociation kinematics. II. Laboratory angular distributions of a hydride model system and the kinematic isotope effect. Kuo-Mei Chen (Dept. of Chem., Nat. Sun Yat-sen Univ., Kaohsiung, Taiwan), Cheng-Chih Pei.
Chem. Phys. (Netherlands), vol.76, no.2, p.219-24 (15 April 1983).
For pt.I see Proc. Natl. Sci. Counc., vol.6, p.148 (1982). In the study of photodissociation processes, a theoretical framework of the laboratory angular distributions of photofragments has been firmly established. Numerical calculations of $F_{l l_1 l_2}^{\,1}(x)$, which is the radial-rotational coupling coefficient in a quantum-mechanical center-of-mass to laboratory-frame transformation, are implemented. The general behavior of $F_{l l_1 l_2}^{\,1}(x)$ as a parametric function of l, l_1, l_2 and x is explored. To illustrate the calculation of the laboratory angular distributions in a photodissociation process, a hydride model system is chosen. The parametric dependences of the photofragment's angular distribution on the initial linear momentum, recoil momentum and the angular momentum of the repulsive state are demonstrated in these numerical calculations. The laboratory angular distributions of photodissociated hydrogen and deuterium atoms exhibit a kinematic isotope effect. (3 refs.)

70969 Energy levels and photopredissociation of the He-I_2 van der Waals complex in the IOS approximation. E.Segev, M.Shapiro (Dept. of Chem. Phys., Weizmann Inst. of Sci., Rehovot, Israel).
J. Chem. Phys. (USA), vol.78, no.8, p.4969-84 (15 April 1983).
Theory for bound states and photodissociation of triatomic molecules based on the IOSA is developed. The theory is applied to the energy levels and photopredissociation of the He-I_2 van der Waals complex. The observed vibrational excitations are shown to be due to the librational mode and the two peaks observed experimentally ($X'=1$ and $W'=1$ excitations) are shown to arise from interaction between librations about skewed and near collinear configuration. A small librational barrier (~ 1 cm^{-1}) is postulated to exist. Interference effects between direct photofragmentation and the resonance enhanced (predissociation) process, as well as interferences between two angular ranges leading to rotational rainbow type phenomena, are predicted to exist. (60 refs.)

70970 Photodissociation of triatomic molecules: rotational scattering effects. R.W.Heather, J.C.Light (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5513-30 (1 May 1983).
An exact quantum method for calculating the state-to-state direct photodissociation probabilities for arbitrary (linear or bent) triatomic molecules is presented. It is shown that this method, which requires the accumulation of Franck-Condon overlap integrals between the initial state and a scattering state satisfying arbitrary scattering boundary conditions, is equivalent to the solution of the driven equations of Band, Freed, and Kouri (1981). For both HCN and ICN the effects of variation of the final state potential on the vibrational and rotational distributions of the CN fragments are examined. Agreement of the authors' exact calculations with the approximate calculations of Morse and Freed (1980) is very good. (41 refs.)

70971 The dynamics of ethylene dimer infrared photodissociation in pulsed molecular beams. M.A.Hoffbauer, K.Liu, C.F.Giese, W.F.Gentry (Chem. Dynamics Lab., Univ. of Minnesota, Minneapolis, MN, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5567-81 (1 May 1983).
Molecular beam experiments have been carried out on the infrared photodissociation of the $(C_2H_4)_2$, $(C_2D_4)_2$, and $(C_2H_4).(C_2D_4)$ van der Waals molecules. Measurements of the frequency and fluence dependences of the photodissociation cross sections were performed over the CO_2 laser frequency range from 900 to 1100 cm^{-1}, which covers the region of the ν_7 out-of-plane vibration of C_2H_4 and the ν_{12} in-plane vibration of C_2D_4. In addition, the monomer product speed and angle distributions were measured in order to obtain information on the final energy disposition in the products. Absorption in either vibrational mode induces dissociation of the cluster, but the linewidth associated with excitation of the ν_7 mode of C_2H_4 is about four times larger than that associated with excitation of the ν_{12} mode of C_2D_4. Two-laser 'hole-burning' experiments demonstrate the homogeneity of the ground-state populations. The absorption intensities are not simply proportional to the number of molecules in the cluster capable of absorbing at a given frequency but instead appear to contain information on the structure of the dimer. The dissociation products are scattered isotropically in the center of mass system, with average recoil velocities which correspond to only a small fraction of the available energy appearing in translation. In the case of $(C_2H_4)_2$, the lack of vibrational modes at the corresponding product internal energies implies that the remaining energy goes into product rotation. Based on the rather detailed spectroscopic and dynamical information provided by these experiments, and the assumption of a skewed parallel structure for the dimer, qualitative arguments are presented that the observed linewidths are determined by the rates of the mode-specific anharmonic coupling of the monomer vibrations to the van der Waals coordinates, but not necessarily by the vibrational predissociation rates. (31 refs.)

70972 Bound-free spectroscopy of Cs_2^+. H.Helm, R.Moller (Molecular Phys. Lab., SRI Internat., Menlo Park, CA, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2493-502 (May 1983).
Bound-free transitions of Cs_2^+ are studied in a fast-ion-beam photofragment spectrometer. Molecular cesium ions are produced by field ionization on a liquid cesium droplet and extracted as an ion beam. Their photodissociation is observed by monitoring the appearance and energy distribution of the charged photofragments Cs^+. In the wavelength range between 4067 and 9500 Å, three photodissociation channels are identified of the type $Cs_2^+(X\,^2\Sigma_g^+) + h\nu \rightarrow Cs_2^{+*} \rightarrow Cs^+(^1S_0) + Cs(nl) + E_{kin}$. At the longest wavelengths studied, photodissociation produces ground-state atoms Cs 6*s*. In the range between 5309 and 4545 Å, excited-state atoms Cs 6*p* are produced. Beginning at 4579 Å, photodissociation leads to formation of both Cs 6*p* and Cs 65*d*. The Cs 5*d* channel dominates at wavelengths around 4100 Å. The angular distribution of photofragments is investigated to help identify the excited molecular states involved in the photodissociation processes. An approximate relative cross section for photodissociation of Cs_2^+ over this wavelength range is obtained. At 7992.2 Å the absolute cross section for photodissociation of Cs_2^+ is measured to be 2×10^{-16} cm^2. The measurements establish, for the first time, a lower limit for the bond energy of $Cs_2^+(X\,^2\Sigma_g^+)$ of 0.59 ± 0.06 eV. This places an upper limit of 3.76 ± 0.06 eV for the ionization potential of $Cs_2(X\,^1\Sigma_g^+)$. (30 refs.)

Triplet 4*d* states of H_2: experimental observation and comparison with an ab initio model for Rydberg-state energies .... See Entry 70795

High-resolution photofragment spectroscopy of the O_2^+ $b^4\Sigma_g^-(v'=5$-$8) \leftarrow a^4\Pi_u(v''=6$-$9)$ first negative system ....See Entry 70865

Rotationally resolved photofragment alignment and the vacuum ultraviolet photodissociation of H_2O ....See Entry 70932

Fluorescence yields from photodissociation of NH_3 and H_2O_2 ....
....See Entry 70944

Dissociation of benzylamine ions following infrared multiple photon absorption, electron impact ionization, and UV multiphoton ionization ..... See Entry 70962

Laser photodissociation of Na_2^+ ions produced by laser resonant and non-resonant ionisation of Na vapour ....See Entry 70963

Deuterium separation by multiple-photon dissociation of 2,2-dichloro-1, 1, 1-trifluoroethane in a two-frequency CO_2 laser field ....See Entry 71027

Orientation dependence in the reaction of Xe* with photodissociation polarized IBr ....See Entry 73327

On the source of difluorocarbene in IRMPD of dichlorodifluoromethane ....See Entry 73354

Time-resolved resonance fluorescence studies of $O(^1D_2)$ yields in the photodissociation of O_3 at 248 and 308 nm ....See Entry 73356

33.80K Multiphoton processes

70973 **The discovery of a 3p Rydberg state in benzene by three-photon resonant multiphoton ionization spectroscopy.** P.M.Johnson, G.M.Korenowski (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.53-6 (6 May 1983).
A new $^1E_{2u}$ $3p_{x,y}$ Rydberg state is found in the three-photon spectrum of benzene at 56080 cm^{-1}, near the previously known $^1A_{2u}$ state. The vibronic structure of these states is found to be intertwined and an e_{2g}, vibration previously assigned to the $^1A_{2u}$ state is suggested to belong to $^1E_{2u}$. This vibration is of such a frequency in both states as to indicate a considerable amount of valence character due to mixing with the nearby $^1E_{1u}$ valence state. (5 refs.)

70974 **Infrared-microwave two-photon spectra of the ν_3 bands of $^{12}CH_3F$ and $^{13}CH_3F$.** P.Shoja-Chaghervand, R.H.Schwendeman (Dept. of Chem., Michigan State Univ., East Lansing, MI, USA).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.27-40 (March 1983).
Infrared-microwave two-photon spectra have been obtained for the ν_3 bands of $^{12}CH_3F$ and $^{13}CH_3F$ with a two-photon spectrometer employing a CO_2 laser and a computer-coupled microwave source operating in the 8-18 GHz region. Even though the intensities of the spectra for the double parity levels in these molecules are inversely proportional to the square of the microwave frequency, transitions have been observed with microwave frequencies of up to 16 GHz. Comparison of these observed two-photon frequencies to frequencies predicted from infrared laser Stark spectroscopy, and to frequencies calculated from vibration-rotation parameters obtained by fitting these and other frequencies, shows agreement to within a few MHz. Spectroscopic parameters for the ground and ν_3 excited states of the two species are reported. (29 refs.)

70975 **The $\tilde{A}^1B_2$-$\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,3-difluorobenzene.** J.M.Hollas, H.Musa, T.Ridley (Chem. Dept., Univ. of Reading, Reading, England).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.125-37 (March 1983).
The A^1B_2-X^1A_1 system of 1,3-difluorobenzene has been observed using the technique of two-photon fluorescence excitation obtained with a pulsed dye laser. Calibration was achieved by a combination of the neon optogalvanic spectrum and etalon fringes. In circular, compared to linear, polarization the bands divide into two groups, those which are B_2-A_1 and which retain their intensity with circular polarization, and those which are A_1-A_1 and lose about 60% of their intensity under the same conditions. These two kinds of bands also show characteristic rotational contours. All of the A_1-A_1 bands whose assignments are established obtain their intensity through vibronic interaction in which the vibration v'_{25} (v'_{14} in the Wilson numbering) mixes the A with, presumably, the X state. There is an important Fermi resonance between the 9^1 and 10^1 11^1 levels. Parts of the one-photon absorption spectrum have been photographed to identify sequences associated with the 0_0^0 band for comparison with those observed in the two-photon spectrum, and to search for bands involving odd quanta of b_2 vibrations, including v'_{25} (v'_{14}); none was found. (11 refs.)

A photoelectron spectroscopic study of (3+1) resonant multiphoton ionization of NO and NH_3 ....See Entry 70950

Deuterium separation by multiple-photon dissociation of 2,2-dichloro-1, 1, 1-trifluoroethane in a two-frequency CO_2 laser field ....See Entry 71027

34.00 ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

34.10 GENERAL THEORIES AND MODELS

(inc. statistical theories, transition state, stochastic and trajectory models, etc; see also 82.20)

70976 **A new multiple (mass ratio) scale analysis of atom-diatom collisions.** B.Chang, H.Rabitz (Dept. of Chem., Princeton Univ., Princeton, NJ, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5531-50 (1 May 1983).
Atom-diatom collisions are investigated within the framework of a general mass weighted mixed coordinate systems. It is found that physically distinct parts of the Hamiltonian are controlled by functions that depend on the mass weighted mixing coefficients of the new coordinates. In principle, the mixing coefficients can be derived variationally from a stationary functional for the T-matrix. The mixed coordinate system developed in this paper can also be used to investigate a quantum mechanical decoupling approximation by parametrizing the mixing coefficients of the new coordinates in terms of the approximation's decoupling parameter. The goal of this paper is to examine the case when the mixing coefficients are expressed in terms of the ES decoupling parameter for vibrational transitions. A brief discussion is also given to the application of this technique to the investigation of the ES method for rotational transitions and vibrational transitions. This approach offers a practical avenue for improving ES results for collision systems having very small mass ratios. It is found in an example that when the collision system strongly satisfies the mass scaling criterion, the method gives uniformly accurate results for all energies and all transitions. When the collision system weakly satisfies the criterion, the method improves only the energy sudden results for multiple quantum transitions at energies which are close to the threshold limit. (39 refs.)

70977 **Approximate, non-relativistic scattering phase shifts, bound state energies, and wave function normalization factors for a screened Coulomb potential of the Hulthen type.** W.Buhring (Phys. Inst., Univ. Heidelberg, Heidelberg, Germany).
Z. Phys. A (Germany), vol.310, no.4, p.255-62 (1983).
Non-relativistic scattering phase shifts, bound state energies, and wave function normalization factors for a screened Coulomb potential of the Hulthen type are presented in the form of relatively simple analytic expressions. These formulae have been obtained by a suitable renormalization procedure applied to the quantities derived from an approximate Schrodinger equation which contains the exact Hulthen potential together with an approximate angular momentum term. When the screening exponent vanishes, the formulae reduce to the exact Coulomb expressions. The interrelation between these formulae and Pratt's 'analytic perturbation theory for screened Coulomb potentials' (1972, 1976) is discussed. (10 refs.)

A uniform WKB approximation for spheroidal wave functions ....See Entry 70758

34.20 INTERATOMIC AND INTERMOLECULAR POTENTIALS AND FORCES

(for molecular solids, see 31.70K)

70978 **On separation theorems for Van der Waals interactions.** A.C.Tanner, A.J.Thakkar (Guelph-Waterloo Centre for Graduate Work in Chem., Univ. of Waterloo, Waterloo, Ontario, Canada), B.Linder.
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.37-40 (6 May 1983).
Two integral representations for energy denominators, the Casimir-Polder form and a convolution form, are used to obtain separation theorems for Van der Waals interactions. The separation theorems are shown to be different and complementary; the convolution form yields the total second-order energy while the Casimir-Polder form yields the dispersion energy. (5 refs.)

70979 **Calculated ro-vibrational fine-structure spectrum and weak-field Zeeman splittings of the O_2Ar van der Waals molecule.** J.Tennyson (Inst. voor Theoretische Chem., Katholieke Univ., Toernooiveld, Nijmegen, Netherlands), J.Mettes.
Chem. Phys. (Netherlands), vol.76, no.2, p.195-202 (15 April 1983).
Ro-vibrational calculations are performed on O_2Ar explicitly including coupling to the O_2 electronic spin. Two different empirical potentials are used and give similar fine-structure spectra. The anisotropy in the potential is found to strongly perturb the O_2 fine-structure spectrum suggesting that the O_2Ar fine-structure spectrum can give detailed information about the anisotropy of the van der Waals interaction potential. Transition strengths for the complex fine-structure transitions are calculated and found to vary by two orders of magnitude. The Zeeman splitting of the levels by interaction with a weak magnetic field is also calculated. (22 refs.)

70980 **Diatomics-in-molecules potential energy surfaces of $(HeH_2)^+$: an extended basis set calculation.** F.Schneider, L.Zulicke (Central Inst. of Phys. Chem., Acad. of Sci., Berlin, Germany), R.Polak, J.Vojtik.
Chem. Phys. (Netherlands), vol.76, no.2, p.259-69 (15 April 1983).
Within the framework of the non-hermitean DIM formulation of Tully and Truesdale (1976), and using 13 symmetry-adapted polyatomic basis functions, ground-state and excited-state potential energy surfaces for $(HeH_2)^+$ have been calculated. Whereas the global shape of the potential energy surfaces is obtained in reasonable agreement with existing ab initio data, at least if scaling is introduced, there are marked differences in the details, e.g. the angular dependences and the splitting of the first and second excited-state potential energy surfaces. The dependence of the results on mixing parameters and scaling as well as implications concerning the predictive power of the DIM method are discussed. (25 refs.)

70981 **Computation of spectroscopic constants of some diatomic hydrides using Morse-Kratzer potential model.** K.Ramani, A.M.Ghodgaonkar (Univ. of Bombay, Bombay, India).
Indian J. Chem. A, vol.21A, no.8, p.803-4 (Aug. 1982). [received: April 1983]
The spectroscopic constants, namely the rotational constant (α_e), the vibrational constant ($\omega_e X_e$) and the binding energy (D_i) of some diatomic hydrides have been computed using the Morse-Kratzer potential. The computed values are in fair agreement with experimental data and rule out any sensitive dependence on arbitrary exponents used in earlier models. (8 refs.)

70982 **Solvation and conformation of methanol in water.** W.L.Jorgensen, J.D.Madura (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA).
J. Am. Chem. Soc. (USA), vol.105, no.6, p.1407-13 (23 March 1983).
Monte Carlo statistical mechanics simulations have been carried out for a dilute solution of methanol in water at 25°C and 1 atm. The water-water interactions were described with the TIP4P potential, while the methanol-water interactions were represented by a modified TIPS potential that incorporates the methyl hydrogens explicitly. The latter feature allowed the internal rotation for the methyl group to be included in the simulation. Statistics for the conformational process were enhanced by umbrella sampling over chopped rotational barriers. The computed heat of solution (-17 ± 5 kcal/mol) is in better accord with experiment (-10.8 kcal/mol) than earlier theoretical results. Furthermore, the preferred conformation of methanol in water is demonstrated to be staggered in contrast to the computed findings of Bolis, Corongiu, and Clementi (1982). Detailed structural results have also been obtained and are discussed. (39 refs.)

70983 **Dunham coefficients for seven isotopic species of CO.** G.Guelachvili, D.de Villeneuve, R.Farrenq, W.Urban, J.Verges (Lab. d'Infrarouge, Univ. de Paris-Sud, Orsay, France).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.64-79 (March 1983).
An extensive work on vibration-rotation spectra in the fundamental $^1\Sigma^+$ electronic state of CO is reported. More than 30000 Doppler-limited measurements corresponding to about 8500 transitions of 255 bands of $^{12}C^{16}O$, $^{12}C^{18}O$, $^{13}C^{16}O$, and $^{13}C^{18}O$, most of them observed for the first time, have been obtained with a high information Fourier transform interferometer on the sequences $\Delta v=1$, 2, and 3. The highest v and J values are 41 and 93, respectively. Experimental vibrational levels are then well observed up to three fourths of the dissociation energy limit. These accurate infrared wavenumbers, with an additional selected set of all previous measurements, have been simultaneously fitted to the Dunham expression in a weighted nonlinear least-squares calculation covering seven different isotopic species. It significantly improves both the number of parameters (U and Δ) obtained by the best previous work (35 instead of 23) and their corresponding standard deviations. The rms of the fit is equal to 13×10^{-6} cm^{-1} (390 KHz). Calculated wavenumbers from the 35 reduced Dunham and mass-scaling coefficients can then be used as secondary standards, even for transitions involving high v and J values of the various isotopic species. These new parameters should be a convenient and useful tool for several purposes, such as assignment of infrared

laser lines and identification of microwave and infrared transitions in astronomical spectra. The Dunham coefficients *Y* are also reported for $^{12}C^{16}O$, $^{12}C^{17}O$, $^{12}C^{18}O$, $^{13}C^{16}O$, $^{13}C^{17}O$, $^{13}C^{18}O$, and $^{14}C^{16}O$. These experimentally determined accurate *Y* should be useful for further examination of the potential energy and dipole moment formulations. (32 refs.)

70984 Evaluation of the spectroscopic constants of the modified Rittner potential by the Simon-Parr-Finlan technique. A.M.Ghodgaonkar, K.Ramani (Western Regional Instrumentation Centre, Univ. of Bombay, Bombay, India), P.D.Prabhavalkar.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.445-9 (May 1983).
A critical examination is shown of the modified Rittner potential by use of the Simon-Parr-Finlan (SPF) technique, including contributions from the polarisability of ions and the van der Waals term. The authors develop an equation for the SPF constants, which are related to spectroscopic constants and the polarisability of the constituent ions. Their analysis indicates excellent agreement for the dissociation energies of 20 alkali halides with available experimental data. The authors also cite theoretical values of the SPF coefficients Y_{20} and Y_{11} for the 20 alkali halides; these also compare favourably with experimental data. (16 refs.)

70985 A multi-reference approach to energy decomposition for molecular interactions. F.Bernardi, M.A.Robb (Istituto Chimico 'G. Ciamician', Bologna, Italy).
Mol. Phys. (GB), vol.48, no.6, p.1345-55 (20 April 1983).
A method is proposed for the analysis of the components of molecular interaction energy using a multireference expansion of the wavefunction. The method can be applied to structural and reactivity problems. The MC-SCF orbitals of the isolated fragments are used as the basis for the construction of the wavefunctions of the molecule as a linear combination of fragment configurations. The energy decomposition is based upon the definition of no-bond and charge transfer configurations and is defined relative to a suitable reference state. The energy of an antisymmetrized product of isolated fragment wavefunctions gives the electrostatic and exchange repulsion energy, while the subsequent inclusion of the charge transfer configurations gives the valence charge transfer associated with bond formation. Orbital mixing between core and valence, core and virtual, and valence and virtual are then computed using second order perturbation theory or MC-SCF. For illustrative purposes the method has been applied to the analysis of the rotational barrier in ethane, the dimerization of methylene and the reaction of methylene and silylene. (21 refs.)

Introduction to atomic and molecular collisions ....See Entry 69801

The empirical general harmonic force field of ethane ....See Entry 70765

Applicability of a pseudopotential CI method to the investigation of ground and excited states of molecular systems: NaCO, Li_2H, Al_2 and AlH ....See Entry 70793

Local normal modes and vibrational adiabatic potentials ....See Entry 70798

Microwave spectral study of cyclopentyl acetylene ....See Entry 70853

Rotational *l*-type doubling in the $kl=+1$ levels of the ν_4 state of PH_3 ....See Entry 70854

High-resolution photofragment spectroscopy of the O_2^+ $b^4\Sigma_g^-(v'=5$-$8)\leftarrow a^4\Pi_u(v''=6$-$9)$ first negative system ....See Entry 70865

Infrared spectrum of stannous oxide (SnO) ....See Entry 70867

Infrared emission spectrum and potential constants of HCl ....See Entry 70868

On the dynamics in compressed methane gas at 3 kbar by inelastic neutron scattering ....See Entry 70989

A theoretical analysis of very low energy collision induced vibrational relaxation in the system He-$I_2(^3\Pi_{0u}^+)$ ....See Entry 70998

Investigation of the structure and intramolecular interaction in phenylthiolene-1,1-dioxides ....See Entry 71035

On vibrational bonding of IHI ....See Entry 71037

Theoretical studies of H_2-H_2 collisions. IV. Ab initio calculations of anisotropic transport phenomena in parahydrogen gas ....See Entry 71682

Two-dimensional Gaussian core model at high temperature ....See Entry 71683

Crystal and molecular structure of hexadecamethylcyclooctasiloxane, $[(CH_3)_2SiO]_8$ ....See Entry 71953

34.40 ELASTIC SCATTERING OF ATOMS AND MOLECULES

70986 Scattering off an ellipsoid: a semiclassical theory. Byung Chan Eu, M.L.Sink (Dept. of Chem., McGill Univ., Montreal, Quebec, Canada).
J. Chem. Phys. (USA), vol.78, no.8, p.4896-904 (15 April 1983).
The WKB approximation is developed for scattering of an atom by an ellipsoidal particle and elastic scattering cross sections are calculated by using the WKB phase shifts in the prolate spheroidal coordinates and uniform WKB approximations for angular spheroidal wave functions. The calculation of cross sections requires the solution of an elliptic boundary condition and is quite simple compared to the calculation in the close coupling theory in the spherical coordinate representation. A version of close coupling theory is briefly discussed in the prolate spheroidal coordinates. (14 refs.)

Introduction to atomic and molecular collisions ....See Entry 69801

A differential equation method for the numerical evaluation of the Airy, Pearcey and swallowtail canonical integrals and their derivatives ....See Entry 70990

34.50 INELASTIC SCATTERING OF ATOMS AND MOLECULES

70987 Production of O^- from CO_2 by dissociative electron attachment. O.J.Orient, S.K.Srivastava (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.681-4 (29 April 1983).
Dissociative electron attachment cross-section measurements for the production of O^- from CO_2 have been performed utilizing a crossed target-beam-electron-beam collision geometry and a quadrupole mass spectrometer. The relative flow technique is employed to determine the absolute values of cross sections. The attachment energies corresponding to the five cross-section maxima are: 4.4 ± 0.1, 8.2 ± 0.1, 13.0 ± 0.2, 16.9 ± 0.2 and 19.4 ± 0.2 eV. The cross sections at these maxima are: 1.43×10^{-19} cm^2, 4.48×10^{-19} cm^2, 8.1×10^{-21} cm^2, 8.1×10^{-21} cm^2 and 1.2×10^{-20} cm^2, respectively. (17 refs.)

70988 Rate coefficient for ion-dipole orbiting collisions. D.R.Bates (Harvard-Smithsonian Center for Astrophys., Harvard Univ., Cambridge, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.19-22 (6 May 1983).
An improved version of the average dipole orientation (ADO) method is used to calculate the rate coefficient for ion-dipole orbiting (capture) rate coefficients. The results agree well with those obtained by the variational and by the statistical method. (9 refs.)

70989 On the dynamics in compressed methane gas at 3 kbar by inelastic neutron scattering. T.Johnson, L.G.Olsson (Dept. of Reactor Phys., Royal Inst. of Technol., Stockholm, Sweden).
J. Phys. B (GB), vol.16, no.10, p.1853-61 (28 May 1983).
The scattering function for methane gas at 295K and 3.0 kbar has been measured for wavevector transfers (*Q*) from 0.8 to 2.0 Å^{-1}. The maximum energy transfers vary over the range of *Q* from 13 to 26 meV. The second energy moments of the scattering function were evaluated for 1.6 Å$^{-1}\leq Q\leq2.0$ Å^{-1} showing a somewhat lower value, on average, than predictions based on decoupled translational and rotational motions. Combining this observation with the discrepancies between the measured scattering function and the calculated one, again assuming decoupled motions, there is an indication of weak coupling effects in the system. The frequency spectrum, reflecting the dynamics of the methane molecule, is estimated for energy transfers up to 17 meV, showing clear discrepancies compared with simple physical models which do not include coupling effects, e.g. the Langevin or rigid-sphere motion. (15 refs.)

70990 A differential equation method for the numerical evaluation of the Airy, Pearcey and swallowtail canonical integrals and their derivatives. J.N.L.Connor, P.R.Curtis, D.Farrelly (Dept. of Chem., Univ. of Manchester, Manchester, England).
Mol. Phys. (GB), vol.48, no.6, p.1305-30 (20 April 1983).
A method for the numerical evaluation of the swallowtail canonical integral $S(x, y, z)$ and its partial derivatives $\partial S/\partial x$, $\partial S/\partial y$ and $\partial S/\partial z$ is described. These integrals are required for applications in semiclassical collision theory and other short wavelength phenomena. The method integrates a set of three linear ordinary differential equations satisfied by $S(x, y, z)$. The authors first explain the method for the simpler cases of the Airy and Pearcey integrals. For $S(x, y, z)$, the integration starts at (0, 0, 0) and then proceeds in the *x* direction to (*x*, 0, 0). This is followed by an integration in the *y* direction to (*x*, *y*, 0). Finally integration in the *z* direction takes us to (*x*, *y*, *z*). The initial conditions at (0, 0, 0) are obtained from the exact series representation of $S(x, y, z)$. The method has been implemented on a computer and a discussion of its advantages and disadvantages is given. Isometric plots of $|S(x, y, z)|$ are presented for fixed values of *x*, *y* and *z* in order to illustrate in a systematic way the main properties of the swallowtail integral. A knowledge of the number of real stationary phase points in different regions of (*x*, *y*, *z*) space together with the shape of the swallowtail caustic are a useful way of understanding and rationalizing the structure in the $|S(x, y, z)|$ plots. (38 refs.)

Introduction to atomic and molecular collisions ....See Entry 69801

Heavy ion collisions. Vol.3 ....See Entry 69804

Laser studies of electronic energy transfer in atomic copper ...See Entry 70807

Oscillatory continuum emission from Br_2 following vacuum ultraviolet laser excitation ....See Entry 70934

Electron emission in asymmetric collisions with fast, heavy projectiles via continuum charge transfer ....See Entry 71004

Collective effects in atomic collisions. I. Constrained Hartree-Fock approach for diatomic systems ....See Entry 71009

Collective effects in atomic collisions. II. Dynamics of charge flows in diatomic collision systems ....See Entry 71010

Alignment and orientation of charge exchange excitation with polarized projectiles ....See Entry 71011

Fine-structure and tensor polarizabilities of $1snd^3D$ levels of He I ($n=3$ to 7) ....See Entry 71033

Theoretical studies of H_2-H_2 collisions. IV. Ab initio calculations of anisotropic transport phenomena in parahydrogen gas ....See Entry 71682

Rotational energy distributions in molecule surface scattering: model calculations for NO/Ag(111) ....See Entry 72908

34.50E Rotational and vibrational energy transfer

70991 Application of the refined Born approximation to atom-rigid rotor collision. G.Staszewska, T.Orlikowski (Inst. of Phys., Nicholas Copernicus Univ., Torun, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.531-8 (April 1983).
Coupled equations obtained by Arthurs and Dalgarno (1960) for the collision of an atom with a rigid rotor have been solved with the help of the refined Born approximation in the case of a helium-atom-hydrogen-molecule scattering problem. An appropriate choice of the trial function allowed the authors to find the solution with high accuracy. For several values of energy and several values of total angular-momentum quantum numbers they give the elements of the reactance matrix and partial cross sections. For comparison they also solved the problem by Gordon's numerical procedure. (13 refs.)

70992 Rotational energy variations of the I_2 (B) molecule by low energy collisions with He. P.Mareca (Inst. de Estructura de la Materia, CSIC, Madrid, Spain), P.Villarreal, G.Delgado-Barrio.
THEOCHEM (Netherlands), vol.10, p.283-8 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The authors present a quasi classical study of the collision between He and iodine in the state B at very low energies (<0.5 cm^{-1}). The collisional process is reduced to a transference of the rotational to kinetic energy. The rotational excitation cross section that the authors report is in good agreement with that obtained by a quantum calculation. The efficiency of this process is enhanced by the formation of collisional complexes. (22 refs.)

70993 Effects of two-quantum processes on vibrational energy transfer in atom-diatom collinear collisions. H.K.Shin (Dept. of Chem., Univ. of Nevada, Reno, NV, USA).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.41-8 (6 May 1983).
An approximate approach is developed to study the interference of one and two-quantum processes in collinear collisions of an atom and a harmonic oscillator. In deriving an explicit expression for vibrational transition probabilities, one-quantum processes are treated rigorously, while the contributions of two-quantum processes are solved in first order. The interference is found to be strong in the collision systems such as H_2+He, especially at high collision energies. In the collisions of a light atom with a heavy diatom, the interference is found to be not important even at such high energies. (17 refs.)

70994 Rate constants for vibrational energy transfer between CO ($\nu=1$) and CH_4 and substituted methane molecules in the temperature range 300 to 80K. D.C.Allen, C.J.S.M.Simpson (Phys. Chem. Lab., Univ. of Oxford, Oxford, England).
Chem. Phys. (Netherlands), vol.76, no.2, p.231-41 (15 April 1983).
Laser fluorescence has been used to measure rate constants for vibrational energy transfer from CO($\nu=1$) to the following molecules CH_4, CD_4, CD_3H, CF_4, CF_3H and CF_3D in the temperature range 300 to 80K. The differences in the rate constants between these related molecules are greatly accentuated at low temperatures; there being a factor of 70 at 300K and 1200 at 80K between the most and least efficient of these partners. (25 refs.)

70995 Excimer laser photolysis studies of translational-to-vibrational energy transfer in collisions of H and D atoms with CO. C.A.Wight, S.R.Leone (Joint Inst. for Lab. Astrophys., NBS, Boulder, CO, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4875-86 (15 April 1983).
Translational-to-vibrational excitation of carbon monoxide is observed as a result of collisions of high energy H and D atoms with CO. The fast atoms are produced by excimer laser photolysis of H_2S, D_2S, HCl, HBr, or HI at 193 or 248 nm. Detection of time and wavelength-resolved infrared fluorescence is used to quantify the CO vibrational state excitation. The CO ($\nu=1-6$) state distribution from H (H_2S, 193 nm, $E_{cm}=2.3$ eV)+CO collisions is 0.74 ± 0.15, 0.15 ± 0.01, 0.08 ± 0.01, 0.01 ± 0.01, 0.02 ± 0.01, and 0.01 ± 0.01. The corresponding state distribution from D (D_2S, 193 nm, $E_{cm}=2.2$ eV)+CO is 0.79 ± 0.19, 0.13 ± 0.01, 0.05 ± 0.02, 0.02 ± 0.02, 0.01 ± 0.01, and 0.01 ± 0.01. Rotational excitation is at least as significant as vibrational excitation based on estimates of the total energy transfer. Measurements of the relative vibrational excitation efficiency as a function of initial H atom energy show that the fraction of translational energy converted to CO vibration increases by more than 300% as the initial H atom energy is increased from 1.0 to 3.2 eV. Good qualitative agreement is found between the experimental results and classical trajectory calculations carried out for collinear collisions of H and D atoms with CO using a simple repulsive interaction potential. (31 refs.)

70996 Rotational and vibrational-rotational relaxation in collisions of $CO_2(01^10)$ with He atoms. D.C.Clary (Dept. of Chem., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
J. Chem. Phys. (USA), vol.78, no.8, p.4915-23 (15 April 1983).
Rotational and vibrational-rotational relaxation of $CO_2(01^10)$ in collisions with He atoms is studied theoretically. Cross sections and rate coefficients have been calculated using a vibrational close-coupling, rotational infinite-order sudden method, together with an ab initio potential energy surface. Comparisons with previous calculations and experiments on rotational relaxation in $He+CO_2(00^01)$ are made. The rotational relaxation cross sections are found to be insensitive to the vibrational dependence of the He-CO_2 potential. Transitions between even and odd rotational states of the (01^10) level have relatively small cross sections. Interesting oscillating structures are predicted for the rotational dependence of the cross section distributions for transitions involving the (01^10) level. (36 refs.)

70997 Atom-molecule collisions at very low energies: a correlation function approach. C.Cerjan, M.Lipkin, S.A.Rice (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4929-37 (15 April 1983).
An extension of the neutron diffraction formalism to low energy atom-molecule scattering including all recoil effects is presented. The nature of the atom-molecule interaction suggests that the diffraction model should be qualitatively correct in the low collision energy regime for vibrational relaxation. The customary impulsive collision assumptions which lead to the use of the Born approximation are replaced by more general transforms which account for possible distortion of the wave function by the potential. Model calculations for a simple vibrational deexcitation process are given. (11 refs.)

70998 A theoretical analysis of very low energy collision induced vibrational relaxation in the system He-$I_2(^3\Pi_{0u}{}^+)$. C.Cerjan, S.A.Rice (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4952-7 (15 April 1983).
Vibrational deexcitation in the low energy collisions of He with I_2 $(^3\Pi_{0u}{}^+)$ is examined within the close-coupled scattering formulation using a sum of pairwise Morse interactions to describe the potential surface. Cross sections for zero total angular momentum are given as a function of energy for various rotational and vibrational transitions with the I_2 molecule prepared in the $n=25$ vibrational state. Similar results for total angular momentum of 2, 1, and 0 are also reported for the $n=1$ initial state of I_2. These calculations are in general agreement with the known experimental results and support the arguments advanced previously to explain the unexpectedly large observed relaxation cross section. (18 refs.)

70999 Rotational energy transfer in HF ($\nu=2$): double resonance measurements and fitting law analysis. R.A.Copeland, F.F.Crim (Dept. of Chem., Univ. of Wisconsin, Madison, WI, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5551-63 (1 May 1983).
Data from overtone vibration-laser double resonance experiments show extemely rapid rotational relaxation in HF ($\nu=2$) for rotational states up to $J=6$ and serve to test energy based fitting laws for rotational energy transfer rate constants. The observed rotational states equilibrate in less than a gas kinetic collision with some individual rates being more than twice the hard sphere collision rate. Energy based fitting laws reproduce the observed evolution of the state populations to within 30% but fail systematically for higher ($J=5$ and 6) rotational levels. Fitting laws formulated for collisions between an atom and a molecule are virtually as successful as those for collisions between two molecules. The extracted rate constants show that multiple rotational quantum energy transfer is an important aspect of relaxation dynamics. (31 refs.)

71000 Impact parameter dependence of *L*- and *K*-shell excitation in I-Ag collisions. E.Morenzoni, M.Nessi, P.Burgy, Ch.Stoller, W.Wolfli (Lab. fur Kernphys., Eidgenossische Tech. Hochschule, Zurich, Switzerland).
Z. Phys. A (Germany), vol.311, no.1-2, p.7-17 (1983).
The impact parameter dependence of the *L*- and *K*-vacancy production of target and projectile was measured in I-Ag collisions at 40 MeV and 63 MeV in an X-ray particle coincidence experiment. A large *L*-vacancy production is found for impact parameters b smaller than the *L*-shell radius with a pronounced increase for $b<250$ fm. The *L*-shell excitation is discussed in terms of $4f\sigma$ excitation and vacancy transfer in the $3p\sigma$, $3d\pi$, $3d\sigma$ molecular orbitals through $3p\pi$-$3p\sigma$ and $3d\delta$-$3d\pi$-$3d\sigma$ rotational-couplings. The $2p\sigma$ excitation probability is obtained from the summed *K*-vacancy production probability, and compared with the prediction of $2p\sigma$ excitation in a multiple collision process. The latter is determined by folding the measured I *L*-shell excitation probability with the impact parameter dependence of the $2p\pi$-$2p\sigma$ rotational coupling. The discrepancy observed at small impact parameters suggests an enhanced $2p\pi$ and $2p\sigma$ excitation at small impact parameters in a one-collision process. The *L*- and *K*-vacancy sharing probabilities are found to be impact parameter independent over a large impact parameter range. (39 refs.)

On the rotational distribution of N_2 in the Ar-N_2-discharge. The O-O-band of the second positive system .... See Entry 70835

Excitation and relaxation of the ν_3 vibration of the OsO_4 molecule in a low-temperature xenon matrix .... See Entry 70875

Excited-state intramolecular proton transfer and vibrational relaxation in 2-(2-hydroxyphenyl)benzothiazole .... See Entry 70940

The state-selective reactions of vibrationally excited CH($X^2\Pi$) with oxygen and nitrogen .... See Entry 73325

34.50H Electronic excitation and ionization (inc. beam-foil excitation and ionization)

71001 Orientation of ^4He (2^3S_1) atoms in collisions with optically oriented Cs atoms. A.P.Bottcher (Inst. of Phys., N. Copernicus Univ., Torun, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.551-62 (April 1983).
Reports the investigations of the orientation of helium atoms in triplet 2^3S_1 metastable state through Penning collisions with optically oriented Cs atoms. The signals of the magnetic resonance in the metastable state were obtained for a wide range of helium pressures 130-12000 Pa. The influence of the discharge parameters on the orientation degree of helium atoms in their metastable state was studied. The experimentally obtained dependence of the magnitude of resonance signal on the helium pressure, on the pumping radiation intensity and on the density of Cs atoms are presented. (15 refs.)

71002 Excitation of vibrational and electronic states in a glow discharge column in flowing N_2. B.Massabieaux, A.Plain, A.Ricard (Lab. de Phys. des Gaz et des Plasmas, Univ. Paris-Sud, Orsay, France), M.Capitelli, C.Gorse.
J. Phys. B (GB), vol.16, no.10, p.1863-74 (28 May 1983).
The excitation and ionisation number densities of different states of N_2 have been measured in a long positive column of a glow discharge in flowing N_2 when the residence time of excited species in the column was varied between 5×10^{-4} and 2.5×10^{-1} s. The vibrational population of the ground state N_2 $(X\ ^1\Sigma_g{}^+,\ \nu)$ and the electron energy distribution function (EDF) have been calculated for different values of gas pressure, electric field and electron densities. For residence times greater than 10^{-2} s the $N_2(X,\nu)$ and the EDF tails are strongly overpopulated. The vibrational population of the excited states $N_2(C^3\Pi_u,\nu')$ and $N_2{}^+(B^2\Sigma_u{}^+,\nu')$ have been experimentally determined by measuring the second positive and first negative band intensities. The measured $N_2(C,\nu')$ distributions are in good agreement with the calculated populations assuming that the $C^3\Pi_u$ state is created by electron collisions and destroyed by radiative emission. The ionic lines emitted from $N_2{}^+(B,\nu')$ have large intensities for long residence times $t>10^{-2}$ s suggesting that the heavy particle reaction: $N_2(X,\nu\geq12)+N_2{}^+(X)\rightarrow N_2(X)+N_2{}^+(B)$ is the main process. (21 refs.)

71003 *n*-changing collisions in intermediate Rydberg states of Li induced by collisions with ground-state parent atoms. B.Dubreuil (Groupe de Recherches sur l'Energetique des Milieux Ionises, CNRS, Univ. d'Orleans, Orleans, France).
Phys. Rev. A (USA), vol.27, no.5, p.2479-84 (May 1983).
Two-step laser-induced-fluorescence techniques are used to investigate n-changing collisional processes $Li(n=9)+Li(2^2S)\rightarrow Li(n'\neq n)+Li(2^2S)+\Delta E_{nn'}$ in a temperature-controlled lithium heat-pipe oven. Numerical identification of the resonance- and collision-induced fluorescences with the hydrogenic rate equations describing the time variation of the $n=7$, 8, 9, 10, 11 populations allows the determination of collisional transfer and quenching rate coefficients. n-changing collisions with $\Delta n=|n-n'|=1$ predominate, and the quenching rate coefficients are found nearly independent of n: $k_n\sim1.3\times10^{-9}$ $cm^3\ s^{-1}$. (23 refs.)

Hyperfine interactions in isolated ions .... See Entry 70582

Laser photodissociation of $Na_2{}^+$ ions produced by laser resonant and non-resonant ionisation of Na vapour .... See Entry 70963

34.50L Chemical reactions, energy disposal, and angular distribution, as studied by atomic and molecular beams

(see also 31.70F and 82.20K Potential-energy surfaces, 82.40D Beam reactions)

Bound-free spectroscopy of $Cs_2{}^+$ .... See Entry 70972

34.70 CHARGE TRANSFER

(see also 82.30 Charge transfer reactions)

71004 Electron emission in asymmetric collisions with fast, heavy projectiles via continuum charge transfer. D.H.Jakubassa-Amundsen (Phys.-Dept., Tech. Univ. Munchen, Garching, Germany).
J. Phys. B (GB), vol.16, no.10, p.1767-81 (28 May 1983).
The ejection of electrons from light target atoms by bare heavy projectiles is described by means of electron capture to the continuum. Calculations of the energy distribution of the electrons are performed within the semiclassical impulse approximation and compared with other theories. As special cases, collisions of Kr with H and Ar with He are considered. Experimental data of the electron spectrum in the forward peak region in (Ar,He) collisions can be well explained. (25 refs.)

71005 A note on the asymptotic behaviour of asymmetric charge transfer theories. L.J.Dube (Fakultat fur Phys., Univ. Freiburg, Freiburg, Germany).
J. Phys. B (GB), vol.16, no.10, p.1783-91 (28 May 1983).
The author reduces the problem of finding the leading velocity dependence of the peaked impulse approximation (PIA), the impulse approximation (IA) and the strong-potential Born (SPB) approximation to that of examining the asymptotic behaviour of the double scattering amplitude in the second Born (B2) approximation. Although no strict mathematical proof is given, he presents evidence (both theoretical and numerical) that this procedure is indeed justified. In contrast to the ν^{-11} dependence of the B2 approximation, the post (prior) form of the PIA gives rise to a leading $\nu^{-11-2l'}$ (ν^{-11-2l}) velocity dependence irrespective of the final (initial) orbital quantum number l (l'). The origin of this discrepancy is discussed and new insight on the use of the peaking approximation is gained. He infers that the asymptotic behaviour (to leading order only) of the IA and SPB approximation agrees with that of the B2 approximation. (28 refs.)

71006 Charge exchange in low-energy $^{3}\mathrm{He}^{+}$-$^{4}\mathrm{He}^{2+}$ collisions. C.A.Falcon (Lab. d'Astrophys., Univ. de Bordeaux I, Talence, France).
J. Phys. B (GB), vol.16, no.10, p.1793-8 (28 May 1983).
Differential scattering cross sections for resonant charge transfer in $^{3}\mathrm{He}^{+}$-$^{4}\mathrm{He}^{2+}$ collisions are calculated in the centre-of-mass energy range of 20 to 100 eV using a quantal formalism of the perturbed stationary-state method. The corresponding partially-integrated cross sections are presented as a function of the acceptance angle of the detector in a typical scattering experiment. The comparison with the merging beam experiments of Jognaux et al. (1978) would indicate that the experimental results are difficult to reconcile with theoretical considerations. (9 refs.)

71007 Capture of Ar K-shell electrons by protons. E.Horsdal-Pedersen, C.L.Cocke (Phys. Dept., Kansas State Univ., Manhattan, KS, USA), J.L.Rasmussen, S.L.Varghese.
J. Phys. B (GB), vol.16, no.10, p.1799-804 (28 May 1983).
The total cross section for the capture of a K-shell electron from Ar by a fast proton has been measured at kinetic energies from 1.5 to 10 MeV. To ensure that the total cross section was indeed obtained the authors also measured the K-shell capture probability as a function of impact parameter at selected energies within the interval 1.5-4 MeV. The cross sections obtained are somewhat higher than previously published cross sections. The reason for the discrepancy is discussed. The new cross sections are compared with recent theoretical cross sections. (19 refs.)

71008 Charge transfer of O^{3+} ions in collisions with atomic hydrogen. S.Bienstock (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA), T.G.Heil, A.Dalgarno.
Phys. Rev. A (USA), vol.27, no.5, p.2741-3 (May 1983).
Cross sections are calculated for the charge transfer of O^{3+} ions in collisions with hydrogen atoms. The cross sections are in satisfactory agreement with ion-trap measurements at energies near 2.5 eV and with ion-beam measurements between 40 eV and 5 kev. The calculated cross sections uniformly exceed the ion-beam values by about 25%. The discrepancy, if real may be attributed to the presence of less reactive metastable ions in the beam. The theory demonstrates that the charge-transfer process results in the emission of visible and ultraviolet photons of specific wavelengths whose detection would serve as a diagnostic probe of the detailed mechanism by which charge transfer proceeds. (10 refs.)

71009 Collective effects in atomic collisions. I. Constrained Hartree-Fock approach for diatomic systems. J.Eichler, Tàk San Ho (Bereich Kern- und Strahlenphys., Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany).
Z. Phys. A (Germany), vol.311, no.1-2, p.19-27 (1983).
As a first step towards a collective treatment of charge flow in harmonic collisions, the authors construct ab initio potential energy surfaces as a function of the internuclear distance and the charge asymmetry between the two atomic species. To this end, the charge asymmetry of its stability value for a given nuclear separation is imposed upon the system by a suitable constraint within a two-centre Hartree-Fock calculation. Energy surfaces are presented for the systems LiH, HF, LiF, and CO. This representation offers a conceptual framework for visualising ionic or covalent molecular states and trajectories describing charge-changing collisions. (24 refs.)

71010 Collective effects in atomic collisions. II. Dynamics of charge flows in diatomic collision systems. J.Eichler, Tak San Ho (Bereich Kern- und Strahlenphys., Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany).
Z. Phys. A (Germany), vol.311, no.1-2, p.29-36 (1983).
For pt.I see ibid., vol.311, p.19-27 (1983). The dynamics of collective charge flow in slow quasimolecular collision systems is investigated. In a first step, a classical Hamiltonian function is derived from a generalised Born-Oppenheimer approach. In a second step, the resulting coupled equations of motion for the relative coordinate and the charge asymmetry between the two atomic species are solved. As an illustration of the method, trajectories are presented for the model system HF. They exemplify elastic and charge-changing collisions as well as trapping into a molecular state. It is suggested that the mechanism studied might play a role in slow collisions of multicharged ions with neutral target atoms. (30 refs.)

71011 Alignment and orientation of charge exchange excitation with polarized projectiles. S.M.Khalid, H.Kleinpoppen (Atomic Phys. Lab., Univ. of Stirling, Stirling, Scotland).
Z. Phys. A (Germany), vol.311, no.1-2, p.57-66 (1983).
The alignment and orientation of hydrogenlike excited atoms produced by electron capture in collisions of spin polarized bare atomic nuclei with atomic targets is described in terms of Stokes parameters. The $H(2p)^{*}$ excited state formed by spin polarized protons making charge exchange collisions on atomic targets is dealt with extensively for the purpose of illustration. The linear polarization and circular polarization of resulting Lyman-α when polarized protons make electron capture collision on atomic hydrogen target are plotted to compare observable aspects of different theories of electron capture. (15 refs.)

Ion induced surface alterations due to electronic charge exchange and chemical reactions .... See Entry 72915

Equilibrium charge states of $^{3}\mathrm{He}$ ions emerging from solid targets at high incident energies .... See Entry 72917

Charge-transfer interactions with *N*-methylquinolinium ion as electron acceptor .... See Entry 73331

34.80 ELECTRON SCATTERING

34.80B Elastic scattering of electrons by atoms and molecules

71012 A self-consistent field approach to atomic scattering: application to low energy positron-hydrogen scattering and annihilation. M.Horbatsch, J.W.Darewych, R.P.McEachran (Phys. Dept., York Univ., Toronto, Ontario, Canada).
J. Chem. Phys. (USA), vol.78, no.9, p.5564-6 (1 May 1983).
The authors consider a formalism for light-particle scattering by atoms in which the wave function is written as a sum of two parts $\Phi_0+\Phi_c$. The first Φ_0 is written as a usual eigenfunction expansion sum (real and/or pseudostate) that contains all the open channels. Φ_c is taken to be a self-consistent Slater-type wave function which is used to describe the system when all particles are in proximity of the nucleus, including possibly correlation effects. The method is tried on low energy e^{+}-H scattering. The calculated phase shifts and Z_{eff} are compared to those of other calculations. The calculated phase shifts are close to the 'exact' results. (7 refs.)

71013 Electron scattering in intense laser fields. A.Weingartshofer, J.K.Holmes, J.Sabbagh, S.L.Chin (Dept. of Phys., St. Francis Xavier Univ., Antigonish, Nova Scotia, Canada).
J. Phys. B (GB), vol.16, no.10, p.1805-17 (28 May 1983).
The authors report quantitative measurements of multiphoton free-free (FF) transitions in a controlled three-beam experiment: electrons elastically scattered from argon in the presence of a CO_2 laser pulse having an average flux density between 10^{6} and 10^{8} W cm^{-2}. They present FF spectra for four incident electron energies, two scattering angles, and two directions of the laser polarisation vector. Electrons that have changed their kinetic energy by as many as eleven photons have been detected. From the spectra the absolute average flux density of the laser pulse was determined and the validity of the sum rule examined. Both results are indirect verifications of the theory. (27 refs.)

71014 Elastic scattering of slow electrons from Ar and Kr atoms. F.Kemper, B.Awe, F.Rosicky, R.Feder (Theoretische Festkorperphys., Univ. Duisburg GH, Duisburg, Germany).
J. Phys. B (GB), vol.16, no.10, p.1819-25 (28 May 1983).
The spin polarisation and the differential cross section of unpolarised electrons, scattered elastically from Ar and Kr atoms in the energy range 10-50 eV, have been calculated relativistically using an effective local potential. Two different exchange-correlation approximations and an absorptive potential part were employed. The authors' results for Kr are generally in good agreement with experimental data. For Ar, they find only partial agreement with the data but good agreement with earlier theory at energies and scattering angles at which there are severe discrepancies with the data. (12 refs.)

71015 Elastic and inelastic scattering of high-energy electrons and X-rays by NH_3, CH_4 and H_2O molecules. B.S.Sharma, A.N.Tripathi (Dept. of Phys., Univ. of Roorkee, Roorkee, India).
J. Phys. B (GB), vol.16, no.10, p.1827-35 (28 May 1983).
A study of elastic and inelastic differential cross sections for high-energy electrons and X-rays has been carried out with a SCF-MO wavefunction obtained in a double-zeta-quality basis of Gaussian contracted functions of Snyder and Basch (1972). The results obtained with this wavefunction were in reasonably good agreement with the recent measurements and other theoretical calculations. (32 refs.)

Introduction to atomic and molecular collisions .... See Entry 69801

Scattering off an ellipsoid: a semiclassical theory .... See Entry 70986

A differential equation method for the numerical evaluation of the Airy, Pearcey and swallowtail canonical integrals and their derivatives .... See Entry 70990

Non-Maxwellian electron velocity distribution resulting from electron-SF_6 attachment collisions .... See Entry 71021

Electron impact excitation of methane .... See Entry 71022

34.80D Atomic excitation and ionization by electron impact

71016 Oscillator strengths and collision strengths for S II. Y.K.Ho, R.J.W.Henry (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.886-90 (15 April 1983).
Collision strengths for electron impact excitation of S II from the ground $3s^{2}3p^{3}\ {}^{4}S^{0}$ state to excited states $3s3p^{4}\ {}^{4}P$, $3s^{2}3p^{2}4s\ {}^{4}P$, and $3s^{2}3p^{2}3d\ {}^{4}P$ are calculated in a close-coupling approximation for the energy range up to 10^{6}K. Also given are oscillator strengths for these transitions and a number of others which involve $3s^{2}3p^{3}\ {}^{2}D^{0}$ and ${}^{2}P^{0}$. Configuration interaction target wave functions, which give oscillator strengths accurate to 30% (except in certain cases), are used in the calculation of collision strengths. (31 refs.)

71017 What we do and do not know about electron impact excitation of atomic hydrogen. J.Callaway, M.R.C.McDowell (Maths. Dept., Royal Holloway Coll., Egham, England).
Comments At. & Mol. Phys. (GB), vol.13, no.1, p.19-35 (1983).
The present state of knowledge derived from both theoretical and experimental information on electron impact excitation of atomic hydrogen is briefly reviewed. Suggestions are made for further calculations and for additional experiments. (26 refs.)

71018 Multipole interference in the excitation of helium by simultaneous electron and laser photon impact. R.S.Pundir, K.C.Mathur (Dept. of Phys., Univ. of Roorkee, Roorkee, India).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.148-51 (25 April 1983).
New theoretical results for the excitation of helium by simultaneous electron and photon impact are presented at an incident electron energy of 200 eV and in the photon wave number regions 186103-186108 cm^{-1}, 186205-186214 cm^{-1}, 191444-191449 cm^{-1} and 191488-191497 cm^{-1}. Significant changes in the cross sections due to the multipole interference effect are predicted in the regions close to the 3^{1}D and 4^{1}D resonances. (15 refs.)

71019 Angular distribution for electron excitation of the $4^{2}S\rightarrow4^{2}P$ transition in ZnII: comparison of experiment and theory. A.Chutjian (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), A.Z.Msezane, R.J.W.Henry.
Phys. Rev. Lett. (USA), vol.50, no.18, p.1357-60 (2 May 1983).
Differential electron-scattering cross sections for inelastic excitation of an ion have been measured for the first time. Experiments were carried out in a crossed electron-ion-beam geometry for the $4^{2}S\rightarrow4^{2}P$ transition in ZnII at 75 eV. In addition, differential cross sections were calculated at energies between 15 and 100 eV in a five-state close-coupling approximation in which $4s$, $4p$, $3d^{9}4s^{2}$, $5s$, and $4d$ states were included. Agreement in shape between theory and experiment at 75 eV is excellent. (17 refs.)

71020 Measurement of Ne $2p^{5}$ $3p$ lifetimes by laser-electron-impact double excitation employing the delayed-coincidence method. I.Tanarro, F.Arqueros, J.Campos (Catedra de Fisica Atomica Experimental, Ciudad Univ., Madrid, Spain).
Phys. Rev. A (USA), vol.27, no.5, p.2533-6 (May 1983).
Radiative lifetimes of six Ne $2p^{5}$ $3p$ states have been measured with uncertainties lower than 1.5% by means of a pulsed electron excitation laser-induced fluorescence technique. This method allows one to obtain fluorescence signals by exciting from resonant as well as from metastable levels at low pressures. The lifetime results are 14.0 ± 0.1, 17.9 ± 0.1, 16.9 ± 0.2, 20.2 ± 0.1, 19.0 ± 0.2, and 20.6 ± 0.2 nsec for the $2p_1$, $2p_2$, $2p_3$, $2p_4$, $2p_5$ and $2p_6$ levels, respectively. (23 refs.)

34.80G Molecular excitation, ionization, and dissociation by electron impact

71021 Non-Maxwellian electron velocity distribution resulting from electron-SF_6 attachment collisions. R.Schmidt, W.Stiller (Central Inst. for Isotope & Radiation Res., Acad. of Sci., Leipzig, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.1, p.41-9 (1983).
A model reaction system is considered consisting of a heat bath of argon atoms (c) and small concentrations of SF_6-molecules (m) and electrons (e) (number densities: $n_e \ll n_m \ll n_c$). Within the model the time behaviour of the electron velocity distribution function is studied under the influence of elastic electron-argon collisions and electron SF_6 attachment collisions. On the basis of the distribution function time-dependent macroscopic quantities (kinetic electron temperature nonequilibrium rate constant of the attachment reaction) are calculated. (9 refs.)

71022 Electron impact excitation of methane. L.Vuskovic, S.Trajmar (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4947-51 (15 April 1983).
Electron energy-loss spectra covering the elastic and inelastic region up to 15.0 eV were obtained at 20, 30, and 200 eV impact energies at scattering angles ranging from 8° to 130°. Relative differential elastic scattering cross sections were determined at each impact energy and then, normalized to the absolute scale by utilizing the 100° differential cross sections of Tanaka et al. (private communication) at 20 and 30 eV and to theory [Dahl et al. J. Phys. B, vol.12, p.2727 (1979)] at 200 eV. The inelastic region of the energy-loss spectrum was divided into five ranges. From the integrated scattering intensities over these ranges with respect to the elastic scattering and from the normalized elastic cross section, the inelastic cross sections were calculated. (38 refs.)

71023 Electron impact excitation from $a^1\Delta_g$ state of molecular oxygen. M.A.Khakoo, W.R.Newell, A.C.H.Smith (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
J. Phys. B (GB), vol.16, no.10, p.L317-22 (28 May 1983).
Energy-loss features observed in the electron impact excitation of discharged molecular oxygen are assigned to the transitions O_2 a $^1\Delta_g$ $(\nu=0) \rightarrow O_2$ $^1\Pi_u$ $(\nu'=0, 1, \ldots 7)$. A Morse potential energy curve is determined for the $^1\Pi_u$ state using the relative intensities of these energy-loss features. (12 refs.)

71024 Vibrational excitation of SO_2 by electron impact via the 3.4 eV resonance. L.Andric (Lab. de Phys. et Optique Corpusculaires, Univ. Pierre et Marie Curie, Paris, France), I.Cadez, R.I.Hall, M.Zubek.
J. Phys. B (GB), vol.16, no.10, p.1837-51 (28 May 1983).
Resonant electron scattering from SO_2 has been observed in the 2.5 to 4.5 eV energy region. Vibrational excitation of the ν_1 mode with up to 23 quanta has been detected with some additional bending quanta. The angular behaviour of the absolute differential cross sections allied to configuration arguments indicate a shape resonance of B_2 symmetry. A reasonable theoretical description was obtained with the boomerang model but a weakness in the usual model for Γ was brought to light. (17 refs.)

71025 Mass spectrometric investigation of NH_3 and CO_2 cluster ions: appearance potentials and stability. K.Stephan, T.D.Mark, J.H.Futrell, A.W.Castleman,Jr. (Abteilung fur Kernphys. und Gaselektronik, Inst. fur Experimentalphys., Leopold Franzens Univ., Innsbruck, Austria).
Vacuum (GB), vol.33, no.1-2, p.77-85 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Electron impact ionization of $(CO_2)_x$ and $(NH_3)_y$ (x up to 5, y up to 10) was investigated in a molecular beam experiment coupled with a double focusing mass spectrometer. A special ion optical system and operating mode (deflection method) was used to discriminate between beam species and background species. For both neat and seeded (He, Ar, Kr) beams the authors have studied neutral cluster beam properties. The exothermicity of the reaction of $CO_2{}^+$ with CO_2 to form $(CO_2)_2{}^+$ was found to be 17.1±5 kcal/mole in good agreement with previous high pressure mass spectrometry determinations. The dissociation energy for the proton bound dimer to $NH_4{}^+ + NH_3$ was found to be 0.60±0.2 eV. In addition, metastable transitions occurring in the mass spectrum of C_3H_8, N_2O and $(CO_2)_x$, $(NH_3)_y$ were investigated by means of decoupling the acceleration and deflection fields of the mass spectrometer, yielding the first results on the stability of cluster ions. (47 refs.)

Emission and laser excitation spectra of rotationally cooled cations: $A\sim{}^2\Pi_u \leftrightarrows X\sim{}^2\Pi_g$ band systems of $X(C\equiv C)_2X^+$, X=Cl,Br ......See Entry 70937

Elastic and inelastic scattering of high-energy electrons and X-rays by NH_3, CH_4 and H_2O molecules ......See Entry 71015

34.90 OTHER TOPICS IN ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

71026 Ionization of the hydrogen negative ion moving in a uniform magnetic field. Wu Li-jing (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China).
Commun. Theor. Phys. (China), vol.1, no.1, p.1-9 (1982).
The ionization of the travelling hydrogen negative ion with high velocity in a uniform magnetic field is discussed by using perturbation theory in the first approximation. The choice of the H^--ion wave function is illustrated with emphasis, and it is shown that various wave functions of the H^--ion affect calculation results. (19 refs.)

35.00 PROPERTIES OF ATOMS AND MOLECULES; INSTRUMENTS AND TECHNIQUES

35.10 ATOMS

35.10B Atomic masses, mass spectra, abundances, and isotopes

(inc. isotope separation; for mass spectrometry, see also 07.75; for radioisotope separation see 28.42H or 82.55)

71027 Deuterium separation by multiple-photon dissociation of 2,2-dichloro-1, 1, 1-trifluoroethane in a two-frequency CO_2 laser field. Pan Daren, Tan Ji-chun (Dept. of Phys., Sichuan Univ., Sichuan, China).
Chin. Phys. (USA), vol.3, no.1, p.137-42 (Jan.-March 1983). [received: May 1983]
Multiple-photon dissociation of CF_3CDCl_2-CF_3CHCl_2 gas mixture in the field of two-frequency CO_2 laser light is studied. The authors obtained a single-step deuterium isotopic enrichment factor of 1600, which is significantly bigger than that obtained by single-frequency CO_2 laser irradiation. (6 refs.)

71028 Separation of Li isotopes by laser deflection of atomic beam. Li Li, Wang Yinde, Li Mingguang, Wang Chongye, Li Junxiang, Huang Shangjun, Shi Fangyong, Cai Zengliang, Fing Ze, Yu Shiying, Zhang Yi, Zhu Qingshi (Qinghai Inst. of Salt Lake, Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.155-8 (Jan.-March 1983). [received: May 1983]
Separation of Li isotopes by laser deflection of atomic beams has been carried out. An atomic beam apparatus with a collimating ratio of 450/1 generates a Li atomic beam of 10^9 atoms/cm^3 at the oven temperature of 600°C. The CW tunable dye laser crossing the atomic beam at a right angle has a linewidth of 6 MHz and its intensity at the 1 cm interaction area is about 70 mW/cm^2. When the laser frequency is tuned to coincide with $^7Li 2^2P_{3/2} F=3-2^2S_{1/2} F=2$ transition, ^7Li atoms are deflected from the beam. The deflected atoms are very pure ^7Li and almost do not contain ^6Li. When the laser frequency coincides with any other transition of 2^2P-2^2S of both ^6Li and ^7Li, no apparent deflection is observed because of the optical pumping of the hyperfine levels of the $2^2S_{1/2}$ ground state. (4 refs.)

71029 Possibility of separating the isotopes ^{127}I and ^{129}I with the aid of a photodissociation iodine laser. T.L.Andreeva, S.V.Kuznetsova, A.I.Maslov, I.I.Sobel'man, E.A.Yukov.
J. Sov. Laser Res. (USA), vol.4, no.1, p.91-7 (Jan.-Feb. 1983).
A method for separating iodine isotopes is proposed, based on the large difference between the rate constants of the excited $I^*(^2P_{1/2})$ and unexcited iodine atoms with radicals CF_3 and with Cl_2 molecules, and on the possibility of selectively acting on the ^{127}I atoms in the states $^2P_{1/2}$ and $^2P_{3/2}$ by radiation from a photodissociation $R^{127}I$ iodine laser ($\lambda=1.315$ μm). The possibility of separating the pure isotope ^{129}I and the mixture ^{127}I with ^{129}I is investigated. (14 refs.)

71030 Independent cross-sections of alkali isotopes produced in various targets bombarded by ^{12}C and ^{18}O ions up to 77 MeV/amu. M.de Saint Simon, P.Guimbal, A.C.Mueller, G.Audi, A.Coc, M.Epherre, S.Haan, M.Langevin, C.Thibault, F.Touchard (CSNSM, Orsay, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.48
The authors report on an online mass-spectrometric study of the isotopic distributions of nuclear reaction products. The two purposes of this experiment are the investigation of a particular aspect of reaction-mechanisms and the study of the possibility for exotic-nuclei production. The measurements have been carried out with the 86 MeV/amu ^{12}C and ^{18}O beams of the synchrocyclotron SC (CERN). By degradation in different sets of graphite slabs, three different energies: 13, 27 and 77 MeV/amu have been chosen. Due to the chemical selectivity for the alkali elements of the device, the isotopic distributions of Li, Na, K, Rb, Cs and Fr were measured in four targets: C, Nb, Ta and U. The independent yields obtained by direct ion counting are converted in cross-sections using a calibration of T. Lund et al. (no refs.)

35.10D Electric and magnetic moments, polarizability

The calculation of diamagnetic susceptibilities from the Thomas-Fermi-Amaldi theory of atoms ......See Entry 70775

Radio-frequency and laser spectroscopy studies of low-lying states in SrI ......See Entry 70802

Variation of tensor polarisability in the interacting 5s*n*d $^1D_2$ Sr Rydberg series ......See Entry 70813

Precision measurement of the Stark shift of the 6*S*-7*S* transition in atomic cesium ......See Entry 70814

Steady state signal in the limit of weak optical pumping with D_1 or D_2 line ......See Entry 70825

Fine-structure and tensor polarizabilities of $1snd^3D$ levels of He I (n=3 to 7) ......See Entry 71033

35.10F Relativistic corrections, fine- and hyperfine-structure constants

71031 Measurement of fine and hyperfine structures and isotope shift in 2^2P-2^2S transitions of lithium by laser induced fluorescence of atomic beams. Li Mingguang, Wang Yinde, Wang Chongye, Li Li, Shi Fangyong, Yu Shiying, Huang Shangjun, Cai Zengliang, Li Junxiang, Feng Ze, Zhang Yi, Zhu Qingshi (Qinghai Inst. of Salt Lake, Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.143-8 (Jan.-March 1983). [received: May 1983]
The fine and hyperfine structures and the isotopic shift in the 2^2P-2^2S transitions were recorded when a lithium atomic beam with 4.7×10^{-3} radian divergence was irradiated perpendicularly by a CW tunable dye laser beam with 6-MHz linewidth, which was continuously scanned over 30-GHz range. The electronic spin coupling splittings in 2^2P terms of ^6Li and ^7Li have been measured to be 9.7±0.4 GHz and 10.5±0.5 GHz respectively and the isotopic shift in the $^2P_{1/2}$ term is 10.7±0.6 GHz. Within tuning range over 2.5 GHz and at laser intensity 4 mw/cm^2 and at 460°C oven temperature, the spacings of the successive lines in the ^7Li $^2P_{1/2} \leftarrow 2^2S_{1/2}$ transitions have been

measured to be 88±11 MHz, 730±73 MHz, and 92±7 MHz respectively; the recorded linewidth was 22 MHz. The linewidth and relative intensities are discussed. (9 refs.)

71032 Precise determination of the ground state hyperfine splitting of $^{135}Ba^+$. W.Becker, G.Werth (Inst. fur Phys., Univ. Mainz, Mainz, Germany).
Z. Phys. A (Germany), vol.311, no.1-2, p.41-7 (1983).
A microwave-optical double resonance experiment has been performed on $^{135}Ba^+$ ions, confined in a RF quadrupole trap. Linewidths as narrow as 0.9 Hz have been obtained on the 7.18 GHz, $F=1$, $m=0$ to $F=2$, $m=0$ transition. Shifts of the resonance frequency due to magnetic stray fields and the electric trapping field have been observed. The final result, extrapolated to zero field strengths, is $\Delta\nu_{HFS}=7183340234.90$ (0.57) Hz. (19 refs.)

71033 Fine-structure and tensor polarizabilities of $1snd^3D$ levels of He I ($n=3$ to 7). W.-D.Perschmann, G.von Oppen, D.Szostak (Inst. fur Strahlungs- und Kernphys., Tech. Univ. Berlin, Berlin, Germany).
Z. Phys. A (Germany), vol.311, no.1-2, p.49-56 (1983).
Using level crossing techniques the fine-structure splittings and tensor polarizabilities of the $1snd^3D$ levels of He I with $n=3$ to 7 have been measured. For excitation the authors used 35 keV He^+-He collisions. Magnetic and electric fields perpendicular to the ion beam have been applied to the target volume. Precision values of the large fine-structure interval $(n^3D_1-n^3D_2)$, of the small one $(n^3D_2-n^3D_3)$, and of the tensor polarizabilities have been determined. (24 refs.)

Energy levels of francium .... See Entry 70794

High resolution laser spectroscopy of low-lying *p*-states in Sr I and Ba I .... See Entry 70797

Radio-frequency and laser spectroscopy studies of low-lying states in SrI .... See Entry 70802

Hyperfine structure of low-lying even levels of $^{161,163}Dy$ and ^{167}Er by atomic-beam laser-RF double resonance .... See Entry 70803

Steady state signal in the limit of weak optical pumping with D_1 or D_2 line .... See Entry 70825

35.10H Ionization potentials, electron affinities

Comments on the unlinked cluster effects in limited CI calculations of electron affinities .... See Entry 70787

35.20 MOLECULES

(see also 61.55, 61.60, and 61.65 Specific structures of metals and alloys, of other inorganic materials, and of organic materials, respectively)

35.20B General molecular conformation and symmetry; stereochemistry

71034 Molecular structure of an aminosilane coupling agent as influenced by carbon dioxide in air, pH, and drying conditions. S.Naviroj, J.L.Koenig, H.Ishida (Dept. of Macromolecular Sci., Case Western Reserve Univ., Cleveland, OH, USA).
J. Macromol. Sci. - Phys. (USA), vol.B22, no.2, p.291-304 (1983).
The molecular structures of the hydrolyzates of γ-aminopropyltriethoxysilane (γ-APS) were studied by Fourier transform infrared spectroscopy (FT-IR). The molecular structure of γ-APS is a function of the pH of the solution and the drying conditions. In the partially cured film, cast from a 20% by weight γ-APS aqueous solution at pH=2, the amine group exists as a protonated amine; and at pH=12 the amine group exists as a free NH_2. The amine group exhibits different structures subject to drying conditions when prepared at natural pH. The sample dried in nitrogen exhibited hydrogen bonding between the SiOH and the NH_2 group. Upon heating, the silanol groups condense and the amine groups no longer hydrogen bond. The increase in the availability of free amine groups was indicated by larger amounts of exchange of NH_2 to ND_2 when the sample was exposed to D_2O vapor. When the hydrolyzed γ-APS at natural pH was dried in CO_2 or in air, a bicarbonate structure was formed, causing the appearance of bands at 1630, 1575, 1488, and 1332 cm^{-1}. E-glass fibers were treated with 2% γ-APS and dried under different conditions, which show the various structures of γ-APS as described above. Differences in γ-APS structures may affect the curing reactions of composite materials. (24 refs.)

71035 Investigation of the structure and intramolecular interaction in phenylthiolene-1,1-dioxides. M.Yu.Antipin, T.E.Bezmenova, G.V.Klimusheva, G.G.Rode, Yu.T.Struchkov.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.553-9 (April 1983). In Russian.
The structure parameters of three phenyl thiolene-1,1-dioxides compounds differing only in a position of a carbon double bond in a 5-member fragment are studied by the X-ray diffraction method. A comparative analysis of the three structures is carried out from the standpoint of their intramolecular interaction which induces differences in their molecular structures. The obtained argumentation relative to the interaction character in the compounds is in good agreement with their spectral data. (16 refs.)

N-N bond in dinitrogen tetroxide .... See Entry 70763

Electronic structure and magnetic properties of the PO_3^{2-} radical: a molecular-orbital study .... See Entry 70772

Molecular orbital study of several γ-aminobutyric acid-uptake inhibitors .... See Entry 70779

Removal of anomalies in CO_2 calculations by using symmetry functions in fixed configurations .... See Entry 70780

Theoretical investigation on hydroformylation reactions. III. Hydrocarbonyliron-propylene π-intermediates .... See Entry 70781

Singlet cyclobutyne: a relative minimum on the C_4H_4 potential energy hypersurface? .... See Entry 70789

Structure and energetics of [4.4.4.4.]fenestrane .... See Entry 70790

Low-temperature infrared spectrum of chlorine nitrate and evidence for the existence of ClOONO .... See Entry 70862

Carbon-13 chemical shifts as a probe for conformational and electronic effects in alkyl vinyl ethers .... See Entry 70900

Carbon-13 nuclear magnetic resonance studies of aspergillomarasmine A anhydroaspergillomarasmine B and of aspergillomarasmine A Ca^{+2} chelate .... See Entry 70919

Experimental and theoretical study on cation radicals of cyclopropane, cyclobutane and cyclopentane .... See Entry 70920

Solvation and conformation of methanol in water .... See Entry 70982

Structure and quadrupole coupling measurements on the NO dimer .... See Entry 71036

Crystal and molecular structure of hexadecamethylcyclooctasiloxane, $[(CH_3)_2SiO]_8$ .... See Entry 71953

Structure and magnetism in a hydroxy bridged binuclear copper(II) system with a 'tunable' binuclear centre .... See Entry 72364

The reaction pathway for the hydration of ketenimine by water dimer. An ab initio study .... See Entry 73317

Transitions and molecular packing in highly purified 1,2-dipalmitoylphosphatidylcholine-water phases. I. Transitions, improved phase diagrams, method of packing analysis, molecular structures of diglyceride, and polar regions .... See Entry 73521

35.20D Interatomic distances and angles

71036 Structure and quadrupole coupling measurements on the NO dimer. S.G.Kukolich (School of Chem. Sci., Univ. of Illinois, Urbana, IL, USA).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.80-6 (March 1983).
Rotational transition frequencies for ^{14}NO-^{14}NO, ^{14}NO-^{15}NO, and ^{15}NO-^{15}NO were measured using a pulsed-nozzle Fourier transform microwave spectrometer. Rotational constants for the different isotopic combinations allowed an unambiguous structure determination. The molecule is in a cis planar structure with a bond between the nitrogen atoms and an NNO angle $\theta=99.6(2)^\circ$. The N-N bond length is 2.236(1) Å and the NO bond length is 1.161(4) Å. Hyperfine structure due to nitrogen quadrupole coupling and spin-rotation interactions was observed and analyzed. Rotation constants, quadrupole coupling tensor, and spin-rotation tensor elements are given. (10 refs.)

N-N bond in dinitrogen tetroxide .... See Entry 70763

35.20G Bond strengths, dissociation energies, hydrogen bonding, etc

71037 On vibrational bonding of IHI. J.Manz (Tech. Univ. Munchen, Garching, Germany), R.Meyer, J.Romelt.
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.607-12 (29 April 1983).
The vibrational bond of IHI is described in analogy to the covalent bond of H_2^+ by a Born-Oppenheimer-type separation of light ('hydrogenic'≙'electronic') and heavy ('iodines'≙ 'protons') particle degrees of freedom. Competing potential energy decreases and hydrogen zero-point energy increases (for the IHI antisymmetric stretching and bending modes) yield a minimum in the iodine symmetric stretching mode's potential energy which supports one bound vibrational IHI state. (22 refs.)

Bond-alternating Huckel-Mobius and related, twisted linear, cyclic and helical systems—their molecular orbitals, energies and phase correlation upon dissociation .... See Entry 70770

MRD-CI calculations for the low-lying electronic states of scandium hydride and titanium hydride .... See Entry 70784

Bond alternation in infinite polyene: Peierls distortion reduced by electron correlation .... See Entry 70786

Scaled diatomics-in-molecules (SDIM) theory. I. General theory and preliminary applications to H_3 and H_4 .... See Entry 70799

The $B(^2\Sigma^+)\rightarrow X(^2\Sigma^+)$ transition (4050-4500 Å) in HgI .... See Entry 70837

Spectroscopy, structure and bonding of high temperature metal halide vapor complexes .... See Entry 70847

Electric dipole moments of $(HC^{15}N)_2$ and $HC^{15}NH^{35}Cl$ .... See Entry 70850

IR bandshapes of weakly H-bonded systems. II. Complexes of methyl-phenol derivatives with dioxane .... See Entry 70856

Involvement of amine protons in *n*-butylamine-cresol hydrogen bonding .... See Entry 70864

Matrix isolation infrared spectra of methylacetate. I. Monomer and dimer absorptions in argon .... See Entry 70879

Applications of four-channel Raman difference spectroscopy to studies in hydrogen-bonded systems .... See Entry 70886

Coherent anti-Stokes Raman spectra of isoalloxazines .... See Entry 70887

Chemical shift anisotropy and second-sphere hydrogen bonding in cobalt (III) complexes .... See Entry 70904

The solvent and field dependence of ^{59}Co NMR linewidths .... See Entry 70905

Computation of spectroscopic constants of some diatomic hydrides using Morse-Kratzer potential model .... See Entry 70981

Evaluation of the spectroscopic constants of the modified Rittner potential by the Simon-Parr-Finlan technique .... See Entry 70984

Diamagnetic anisotropy of some hydrogen-bonded molecules .... See Entry 71038

Diatomic molecules and metallic adhesion, cohesion, and chemisorption: a single binding-energy relation .... See Entry 72339

On the magnetic behaviour of some hydrogen bonded molecules in crystals .... See Entry 72576

An ab initio calculation of the dissociation $C_2H_2(^1\Sigma^+)\rightarrow C_2H(^2\Sigma^+)+H(^2S)$ .... See Entry 73332

35.20J Barrier heights (internal rotation, inversion); rotational isomerism, conformational dynamics

1-butyne microwave spectrum, barrier to internal rotation, and molecular dipole moment .... See Entry 70852

Methylenecyclohexenes: inversion barriers from the far-infrared spectra .... See Entry 70857

Solvation and conformation of methanol in water .... See Entry 70982

Pseudo Jahn-Teller effect and distortion isomers of $CuBr_2(NH_3)_2$ crystals .... See Entry 72360

An analysis of the density dependence of the butane isomerization rate .... See Entry 73326

35.20M Electric and magnetic moments (and derivatives), polarizability, and magnetic susceptibility

71038 Diamagnetic anisotropy of some hydrogen-bonded molecules. M.M.Abdel-Kader (Phys. Dept., Univ. of Cairo, Giza, Egypt).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.539-46 (April 1983).
The tensor diamagnetic susceptibilities (χ_1, χ_2 and χ_3) of four aromatic compounds namely 1- and 2-naphthoic acid and α- and β-naphthol were measured. From these measurements and the orientation of molecules as given from the crystal structures of these compounds, the principal molecular susceptibilities (K_1, K_2 and K_3) have been calculated. The observed magnetic anisotropies and other magnetic data are interpreted on the basis of the crystal structures and the system of hydrogen bonds of these molecules. (26 refs.)

Optimisation of multi-configuration self-consistent field (MCSCF) orbitals. II. Calculation of total pi-electron energies and dipole moments of some non-alternant hydrocarbons .... See Entry 70762

Coiolis intensity perturbations of the ν_4 band of SF_6 .... See Entry 70838

Determination of the dipole moment of nitrosyl fluoride in the (001) and (101) states by combination of microwave and laser Stark data .... See Entry 70849

Electric dipole moments of $(HC^{15}N)_2$ and $HC^{15}NH^{35}Cl$ .... See Entry 70850

The microwave spectrum of the DO_2 radical .... See Entry 70851

1-butyne microwave spectrum, barrier to internal rotation, and molecular dipole moment .... See Entry 70852

Stark effect in azo compounds with long hydrocarbon tail .... See Entry 70929

Simultaneous transitions in light-scattering spectra induced by collisions between molecules .... See Entry 70943

The temperature dependence of the Cotton-Mouton effect of ethane, ethene and ethyne .... See Entry 70959

The $\tilde{A}^1B_2$-$\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,3-difluorobenzene .... See Entry 70975

Dunham coefficients for seven isotopic species of CO .... See Entry 70983

Structure and quadrupole coupling measurements on the NO dimer .... See Entry 71036

Dependences of the parameters of the liquid-crystal order on the molecular hyperpolarizability .... See Entry 71877

On the magnetic behaviour of some hydrogen bonded molecules in crystals .... See Entry 72576

Molecular quadrupole moment and effective-quadrupole-centre of fluorobenzene .... See Entry 72764

Field-gradient-induced birefringence in dilute solutions of furan, thiophen and selenophen in cyclohexane .... See Entry 72765

Magnetic electronic Raman optical activity of osmium (IV) hexabromide, iridium (IV) hexachloride and uranocene .... See Entry 72797

35.20P Rotation, vibration, and vibration-rotation constants

71039 Observation of the $v=1\leftarrow 0$ band of SH ($X^2\Pi$) with a difference frequency laser. P.F.Bernath, T.Amano, M.Wong (Herzberg Inst. of Astrophys., Nat. Res. Council, Ottawa, Ontario, Canada).
J. Mol. Spectrosc. (USA), vol.98, no.1, p.20-6 (March 1983).
The fundamental vibration-rotation band of SH ($X^2\Pi$) has been studied in absorption at Doppler-limited resolution with an estimated accuracy of 0.002 cm^{-1}. The band origin ($\nu_0=2598.7675\pm0.0003$ cm^{-1}) and the molecular constants for the excited vibrational state ($v=1$), as well as improved molecular constants for the ground vibrational state, have been determined in a least-squares fit. (29 refs.)

The empirical general harmonic force field of ethane .... See Entry 70765

On the rotational distribution of N_2 in the Ar-N_2-discharge. The O-O-band of the second positive system .... See Entry 70835

Ab initio second-order Moller-Plesset calculations of the vibrational spectra of cyclobutadiene and its isotopic derivatives .... See Entry 70836

The $B(^2\Sigma^+)\rightarrow X(^2\Sigma^+)$ transition (4050-4500 Å) in HgI .... See Entry 70837

The microwave spectrum of the DO_2 radical .... See Entry 70851

1-butyne microwave spectrum, barrier to internal rotation, and molecular dipole moment .... See Entry 70852

Microwave spectral study of cyclopentyl acetylene .... See Entry 70853

Rotational l-type doubling in the $kl=+1$ levels of the ν_4 state of PH_3 .... See Entry 70854

Submillimeter rotational spectrum of nitrogen dioxide $^{14}N^{16}O_2$ .... See Entry 70855

IR bandshapes of weakly H-bonded systems. II. Complexes of methyl-phenol derivatives with dioxane .... See Entry 70856

Infrared spectrum of stannous oxide (SnO) .... See Entry 70867

Infrared emission spectrum and potential constants of HCl .... See Entry 70868

Vibrational spectra and force constants of symmetric tops. Rotational analysis of ν_3 and several hot bands of $H_3Si^{79}Br$ and $H_3Si^{81}Br$ near 430 cm^{-1} .... See Entry 70869

Coriolis perturbation in the fundamentals ν_{11} and ν_{23} of cis, cis-1,4-D_2-buta-1,3-diene .... See Entry 70870

Vibrational spectra and force constants of symmetric tops—rotational analysis of the ν_2, ν_5, $\nu_3+\nu_6$ infrared system of H_3SiI near 900 cm^{-1} .... See Entry 70874

Studies of isolated GeH stretching frequencies. I. Data, assignments and effects of conformation .... See Entry 70876

Franck-Condon effect in resonance Raman scattering of TCNQ- radical. The excitation profiles of 336 cm^{-1} and 2192 cm^{-1} fundamentals .... See Entry 70880

Determination of A_0 and D_K for CD_3I from the ν_4 Raman and IR bands .... See Entry 70883

Vibrational spectra and analysis of $Te_6{}^{4+}$, a trigonal-prismatic cluster cation .... See Entry 70889

Rotational analysis of the $^2B_1$ ($K'=0$)$\leftarrow$$^2A_1$ ($K''=1$) bands with $\nu_2'=6$, 7 and 10 in the excitation spectrum of NO_2 .... See Entry 70891

The UV spectrum of ^{18}OD .... See Entry 70895

The vacuum ultraviolet absorption spectrum of SiO in rare gas matrices .... See Entry 70898

Comments on the vibrational structure in dye's superexcitation spectra .... See Entry 70954

Relative intensities of P, Q, and R branches of ν_4 of SF_6 .... See Entry 70956

Infrared-microwave two-photon spectra of the ν_3 bands of $^{12}CH_3F$ and $^{13}CH_3F$ .... See Entry 70974

The $\tilde{A}^1B_2$-$\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,3-difluorobenzene .... See Entry 70975

Dunham coefficients for seven isotopic species of CO .... See Entry 70983

Evaluation of the spectroscopic constants of the modified Rittner potential by the Simon-Parr-Finlan technique .... See Entry 70984

Structure and quadrupole coupling measurements on the NO dimer .... See Entry 71036

35.20S Hyperfine and fine-structure constants

A new heart for Rb frequency standards?: the evacuated, wall-coated sealed cell .... See Entry 70036

Electronic structure and magnetic properties of the $PO_3{}^{2-}$radical: a molecular-orbital study .... See Entry 70772

The microwave spectrum of the DO_2 radical .... See Entry 70851

X-ray absorption spectra of water and ammonia molecules .... See Entry 70899

Experimental and theoretical study on cation radicals of cyclopropane, cyclobutane and cyclopentane .... See Entry 70920

The hyperfine structure of akaline-earth monohalide radicals: new methods and new results 1980-1982 .... See Entry 70924

Calculated ro-vibrational fine-structure spectrum and weak-field Zeeman splittings of the O_2Ar van der Waals molecule .... See Entry 70979

35.20V Ionization potentials, electron affinities, molecular core binding energy

71040 Calculation of vertical ionization potentials of hydrogen peroxide by perturbation corrections to Koopmans' theorem. T.Minato, D.P.Chong (Dept. of Chem., Univ. of British Columbia, Vancouver, BC, Canada).
Can. J. Chem. (Canada), vol.61, no.3, p.550-2 (March 1983).
Vertical ionization potentials (VIPs) of hydrogen peroxide are calculated by perturbation corrections to Koopmans' theorem and its conformation is investigated on the basis of the calculated VIPs. The calculated VIPs compare well with the observed values. The analysis based on the VIPs gives a reasonable conformation, although the energy-optimizing procedure cannot reproduce the skew conformation. The lone pair-lone pair interactions are also discussed. (8 refs.)

MS Xα and LCAO Xα calculations of ionization potentials. A comparison with Koopmans' theorem and accurate calculations .... See Entry 70773

Comments on the unlinked cluster effects in limited CI calculations of electron affinities .... See Entry 70787

The first band in the He(I) photoelectron spectrum of the CH_2Cl free radical .... See Entry 70945

Photoelectron spectra of 1,2,3-triazine and its methyl derivatives .... See Entry 70946

Laser photoelectron spectroscopy of MnH^- and FeH^-: electronic structures of the metal hydrides, identification of a low-spin excited state of MnH, and evidence for a low-spin ground state of FeH .... See Entry 70947

Ionization potentials of 1:1 alternating copolymers containing a pendant carbazolyl group as determined by UV photoelectron spectroscopy .... See Entry 72945

35.20X Mass spectra

Molecular beam photoionization study of H_2S .... See Entry 70961

Mass spectrometric investigation of NH_3 and CO_2 cluster ions: appearance potentials and stability .... See Entry 71025

35.20Y Correlation times in molecular dynamics

IR bandshapes of weakly H-bonded systems. II. Complexes of methyl-phenol derivatives with dioxane .... See Entry 70856

35.80 ATOMIC AND MOLECULAR MEASUREMENTS AND TECHNIQUES

Pulse transformer drive circuit for a molecular-beam source .... See Entry 70149

Measurement of the time-of-flight spectrum of a supersonic beam with an AI-128-2 multichannel pulse-height analyzer .... See Entry 70754

36.00 STUDIES OF SPECIAL ATOMS AND MOLECULES

36.10 EXOTIC ATOMS AND MOLECULES (CONTAINING MESONS, MUONS, AND OTHER ABNORMAL PARTICLES)

71041 Search for two-photon emission from 2S states of low-Z muonic atoms. A.L.Carter (Dept. of Phys., Carleton Univ., Ottawa, Ontario, Canada), C.R.Cox, M.S.Dixit, G.W.Dodson, M.Eckhause, C.K.Hargrove, E.P.Hincks, J.R.Kane, H.Mes, A.M.Rushton, R.T.Siegel, R.E.Welsh.
Phys. Lett. B (Netherlands), vol.124B, no.6, p.465-8 (12 May 1983).
A search for two-photon emission from 2S states of low-Z muonic atoms has been made. Intrinsic Ge detectors were positioned around targets of Li, Be, B, or their hydrides, or a vessel containing B_2H_6, N_2, or O_2. Upper limits on the fraction of stopping muons which formed metastable 2S states range from $\approx10^{-3}$ to 10^{-5}. (8 refs.)

Damping state method and kaonic bound states .... See Entry 70407

Combined analysis of inelastic electron-scattering and muonic-atom hyperfine-splitting data: an application to ^{152}Sm .... See Entry 70489

36.20 MACROMOLECULES AND POLYMER MOLECULES

(for biological macromolecules, see also 87.15; for polymer reactions and polymerization, see 82.35)

71042 Problem of multiple lines in absorption bands in the infra-red spectra of urethanes and polyurethanes. L.I.Maklakov, V.L.Furer, A.L.Furer.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.3, p.162-5 (1983). In Russian.
Previously Maklakov et al. (Zh. Prikl. Spektroskopii, vol.34, no.2, p.270 (1981)) studied the vibrational spectra of methyl-N-methylcarbonate and concluded that shifts and branches in IR lines arise due to molecular clusters of various lengths. An attempt is made to reveal similar interactions between bonds and valence angles in associated molecules, affecting the amide lines in the IR spectra of polyamides, based on a model of hydrogen-bonded dimers and trimers in polyurethanes. The model is shown to account satisfactorily for band splitting in the IR absorption spectra of polyurethanes. (7 refs.) *C.J.S.*

71043 Link between the conformation of macromolecules and the morphology of polyoxymethylene. B.V.Ozeretskovskii (Inst. Chem. Phys., Acad. of Sci., USSR).
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.3, p.193-7 (1983). In Russian.
Polyoxymethylene is chosen for the present study since its macromolecular conformation in the crystalline state is known. A comparison is presented of all the atomic group absorption bands, and the conditions of formation of various super-molecular structures are studied. Spherolite and hedrite formation can occur during crystallisation from a melt or from solution, and these processes are studied in terms of the measured IR spectra, which are particularly sensitive to conformational changes in the macromolecular vibrational frequency in the range 700-1400 cm^{-1}. A wide range of polymeric chain conformation at conditions far from equilibrium, which leads to a dissipative system. In such a system each morphological form has a specific conformational set. (7 refs.) *C.J.S.*

71044 Phase transition in a model of long polymers with excluded volume. N.Angelescu, V.B.Priezzhev (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.913-19 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.453-62 (Sept. 1982). [received: May 1983]
A model of long polymers interacting with one another through repulsive forces with an additional intramolecular interaction between neighboring atoms in a polymer chain is proposed. The existence of a thermodynamic limit of the free energy for such a system is proved. It is shown by the method of reflectional parity that the system undergoes a phase transition, i.e. the free energy is identically equal to zero at a temperature below a certain fixed temperature (ground state) and different from zero at high temperatures. (13 refs.)

Internal variables and the thermodynamics of macromolecule solutions .... See Entry 71607

Diffusion and orientability of rigid-rod molecules .... See Entry 71868

Single-chain scattering in heterogeneous block copolymers ...... See Entry 71909

Conformational dynamics of proteins and elementary molecular 'machines' .... See Entry 73508

Configurations of the carotenoid in carotenoproteins from Rhodospirillum rubrum. A resonance Raman study .... See Entry 73513

Evidence for conformational substates of rhodopsin from kinetics of light-induced charge displacement .... See Entry 73514

Study of the conformational stability of immunoglobulin G in monolayers at the phase boundary between aqueous NaCl and octane .... See Entry 73516

36.40 ATOMIC AND MOLECULAR CLUSTERS

71045 Structure and stability of Li_4 and Li_6 clusters. D.Plavsic, J.Koutecky, G.Pacchioni, V.Bonacic-Koutecky (Inst. fur Phys. Chem., Freie Univ. Berlin, Berlin, Germany).
J. Phys. Chem. (USA), vol.87, no.7, p.1096-7 (31 March 1983).
The results of ab initio CI calculations on Li_4 and Li_6 clusters are compared with those recently obtained by Richtsmeier et al. (1982) with the DIM method. The planar sections of the fccub Li crystal lattice exhibiting singlet ground state are the most stable Li clusters. More compact structures such as $Li_4(T_d)$ and $Li_6(O_h)$ are less favored and have a triplet ground state. (7 refs.)

71046 Theoretical formulation of occurrence of microclusters from supersaturated metal vapour in cold inert gas. S.Ozawa, K.Tanikawa.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.127-33 (1982).
The process of occurrence of microclusters from supersaturated metal vapour in one dimensional diffusion chamber is formulated on the basis of a kinetic theory of gases. The temperature and the number density of single vapour atoms are determined at various positions in the diffusion chamber. Using these values of the parameters, the number densities of clusters are numerically calculated as a function of time. It has been shown that the most of the clusters are formed within about 1×10^{-6} sec in a narrow region near the cooled wall of the diffusion chamber. The size distribution of clusters is also discussed. (26 refs.)

Mass spectrometric investigation of NH_3 and CO_2 cluster ions: appearance potentials and stability .... See Entry 71025

36.90 OTHER SPECIAL ATOMS AND MOLECULES

71047 Critical remarks on a scaling law for inner-shell ionization. B.Muller, J.Reinhardt, W.Greiner (Inst. fur Theoretische Phys., Johann Wolfgang Goethe-Univ., Frankfurt am Main, Germany), G.Soff.
Z. Phys. A (Germany), vol.311, no.3, p.151-5 (1983).
In superheavy quasimolecules the number of created $1s\sigma$-vacancies per collisions $P_{1s\sigma}$ can be evaluated approximately by a simple scaling law. This analytical relation correctly reproduces the measured dependence of $P_{1s\sigma}$ on the impact parameter, bombarding energy and combined nuclear charge $Z=Z_1+Z_2$. It is emphasized, however, that the absolute ionization magnitude is underestimated typically by a factor of four. This discrepancy has been successfully resolved by the inclusion of multi-step excitation processes. The derivation of the normalization constant in a scaling law previously reported by Armbruster's group is incorrect in the framework of first order perturbation theory. (15 refs.)

40.00 CLASSICAL AREAS OF PHENOMENOLOGY

(inc. applications)

41.00 ELECTRICITY AND MAGNETISM; FIELDS AND CHARGED PARTICLES

(see also 03.50 Maxwell theory: general mathematical aspects)

41.10 CLASSICAL ELECTROMAGNETISM

41.10D Electrostatics, magnetostatics

71048 An accurate scalar potential finite element method for linear, two-dimensional magnetostatics problems. T.W.McDaniel, R.B.Fernandez, R.R.Root, R.B.Anderson (IBM Corp., Rochester, MN, USA).
Int. J. Numer. Methods Eng. (GB), vol.19, no.5, p.725-37 (May 1983).
Assesses the accuracy of a commercially available computer software package for finite element method calculations of magnetostatic fields. The computer program, MSC/NASTRAN, is well known for its wide applicability in structural analysis and heat transfer problems. The authors exploit the fact that the differential equations of magnetostatics are identical to those for heat transfer if the magnetic field problem is formulated with the reduced scalar potential. Consequently, the powerful, optimized numerical routines of NASTRAN can immediately be applied to two- and three-dimensional linear magnetostatics problems. Application of the NASTRAN reduced scalar potential approach to a 'worst case' two-dimensional problem for which an analytic solution is available has yielded much better accuracy than was recently reported for a reduced scalar potential calculation using a different finite element program. Furthermore, the authors' method exhibits satisfactory performance with regard to computational expense and accuracy for a linear electromagnet with an air gap. (10 refs.)

71049 Electrostatic field of two flat equipotential tapes. K.Adamiak (Inst. Elektrotech. Politech. Swietokrzyskiej, Kielce, Poland).
Rozpr. Electrotech. (Poland), vol.27, no.4, p.939-48 (1981). [received: May 1983]
The paper considers the edge problem for the Laplace equation when the surfaces, on which Dirichlet type conditions are assumped, are the internal surfaces of the area for which a solution is sought. The solution has been reduced to a system of Fredholm integral equations of the 1st kind. Calculations have been made of a field coming from 2 thin equipotential tapes. The method of finite differences was used in the calculations. (27 refs.)

71050 Surface modes and optical absorption of a small sphere above a substrate. R.Ruppin (Soreq Nuclear Res. Centre, Yavne, Israel).
Surf. Sci. (Netherlands), vol.127, no.1, p.108-18 (April 1983).
An exact derivation of the electrostatic surface modes of a sphere above a substrate is presented. The absorption spectrum of the sphere is calculated and compared with that of an isolated sphere. The interaction with the substrate causes the main absorption peak to shift to the low frequency side, and also gives rise to additional absorption peaks. The deficiencies of the dipole approximation, which is often used, are discussed. (19 refs.)

71051 Forceless distribution of an axio-symmetrical current. Yu.P.Kovbasenko.
Tekh. Elektrodin. (USSR), no.2, p.9-17 (March-April 1983). In Russian.
An examination is made of a forceless magnetic field possessing axial symmetry and of which the coefficient of proportionality between current density and flux density is of variable magnitude. It is shown that the initial system of equations reduces to the solution of well-studied differential equations. Some particular solutions and the forceless magnetic configurations corresponding to them are analysed. (5 refs.) *A.J.B.*

71052 Electrostatic hazards—a review of modern trends. N.Gibson (Organics Div., Imperial Chem. Industries plc, Manchester, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.1-11
The criteria and principles that can be used in the assessment of electrostatic hazards during the handling of liquids and powders in industrial situations are reviewed. Modern trends in the assessment of risk associated with metal plant, nonconductors (plastics), bulk liquid and mists, bulk powder and dust clouds and personnel are discussed. (31 refs.)

71053 Prevention of electrostatic hazards associated with shipboard inert gas operations. J.S.Mills, E.J.Haighton (Thornton Res. Centre, Shell Res. Ltd., Chester, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.13-19
During the inerting of a cargo tank on a crude oil or product carrier an electrostatic charge accumulates in the ullage space owing to the carry-over of charged soot particles from the inert gas generator. Shipboard trials have been performed to determine if the resulting space potential attains a value sufficient to generate electrostatic discharges capable of igniting flammable ullage gases if the inert gas system failed and air entered the cargo tanks. It was found that potentials are limited to a value below that needed to generate hazardous brush coronas but may be sufficient to produce hazardous sparks from isolated conductors. (6 refs.)

71054 The ignition of natural gas by spark discharges from the body. N.Wilson (Shirley Inst., Manchester, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.21-7
It is known that the ignition of certain flammable gases by spark discharges from the body requires a greater electrostatic energy on the body than the minimum ignition energy of the gas. The three factors which are considered to contribute to this behaviour are (a) the fragmentation of the discharge into discrete sparks, (b) the loss of energy to the body resistance and (c) the quenching effect of the electrodes. The relative importance of these factors is examined for the case of a stoichiometric mixture of natural gas and air. (6 refs.)

71055 Intermittent contact electrification of polymers: simulated and experimental results of polystyrene. J.Fuhrmann, H.J.Streibel (Fachbereich Chem., Univ. Kaiserslautern, Kaiserslautern, Germany).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.145-9
By the help of a reaction kinetic model describing the electrostatic charaging of polymers the time dependent densities of excess electrons in the polymer surface and in the polymer bulk are computed and compared to experimental results. The importance of the band bending during contact and the influence of polymer parameters, e.g. energy level of the polymer band gap states and barrier heights between these levels, and the experimental parameters, such as work function of the contacting metal, contact ratio and contact frequency, on transient and steady-state contact electrification are demonstrated. (14 refs.)

Electrostatics 1983. Sixth Conference on Electrostatic Phenomena ....See Entry 69787

Integral-equation method for electric microfield distributions ..See Entry 71691

Some basic gas and surface discharge phenomena in electrostatics ....See Entry 71833

The resolution times of water-in-oil emulsions subjected to external electric fields ....See Entry 73378

41.10F Steady-state electromagnetic fields; electromagnetic induction

71056 Electromagnetic phenomena in solid iron. Z.Cerovsky, B.Heller, M.Stafl (CSAV, Praha, Czechoslovakia).
Acta Tech. CSAV (Czechoslovakia), vol.28, no.1, p.40-9 (1983).
Processes in solid iron are analysed both in the case of an impressed sinusoidally time-dependent exciting current and also of an impressed sinusoidally time-dependent voltage. The formulae derived for both cases allow specifying losses and also determining the phase angle between an impressed quantity of current or voltage and the first harmonic component of the quantity representing the response. As the basis of the theoretical discussion, an idealized rectangular magnetization curve is employed. The response upon a sinusoidally time-dependent current is represented by a voltage with a non-sinusoidal waveform, induced in the coil. In the second case, the response upon an impressed sine voltage is represented by a current with a non-sinusoidal waveform. In the first case, the angular lag between the impressed current and the first harmonic of voltage is $\sigma=27°33'$. In the second case, the angular lag between an impressed voltage and the first harmonic of current is $\sigma=23°$. On the ground of experiments, a correcting coefficient was introduced in calculation of losses, which takes into consideration a real development of a magnetization curve in a ferromagnetic material. (6 refs.)

71057 Current displacement analysis and calculation of impedance in a system of two flat conductors. W.Lipinski, M.Gramz, P.Krason (Inst. Automatyki Przemyslowej Politech. Szczecinskiej, Szczecin, Poland).
Rozpr. Electrotech. (Poland), vol.27, no.4, p.949-58 (1981). [received: May 1983]
A distribution of eddy-current density has been analysed in a system consisting of two flat conductors. A method of impedance calculation has been given for systems which are described by the integral Fredholm equation of the second kind with symmetrical kernel. Examples of the numerical computation have been shown in the form of graphs. (15 refs.)

71058 Diffusion of a transient electromagentic field in a spherical conducting element. J.Golebiowski (Inst. Elektrotech. Politech. Bialostockiej, Bialystok, Poland).
Rozpr. Electrotech. (Poland), vol.27, no.4, p.959-66 (1981). [received: May 1983]
The induction transient $B(t)$ in the centre of a sphere on exciting current step feeding was determined from the vector diffusion equation. The equation was obtained directly without the need to determine the operating transfer function. (8 refs.)

71059 Numerical analysis of the magnetic field of a heating inductor. G.Szymanski (Inst. Elektrotech. Przemyslowej Politech. Poznanskiej, Poznan, Poland).
Rozpr. Electrotech. (Poland), vol.27, no.4, p.1063-70 (1981). [received: May 1983]
A numerical method for calculation of the magnetic field generated outside a nonconducting ferromagnetic bar of infinite length by current flowing through conductors parallel to it is presented. The integral equation approach is applied, which permits an approximate solution of the problem considered. As an example, the magnetic field outside a rectangular bar is calculated using digital computer. The considerations are based on the idealized assumption that the permeability of the ferromagnetic bar is constant. (19 refs.)

71060 Electromagnetic forces in a free jet of a conducting fluid placed in a longitudinal variable magnetic field of a current loop. A.F.Kolesnichenko.
Tekh. Elektrodin. (USSR), no.2, p.7-9 (March-April 1983). In Russian.
The R-networks method is used to solve the equations of an electromagnetic field for a hollow cylindrical jet of conducting fluid placed in a variable magnetic field of a single-turn solenoid. The curve of the electromagnetic forces arising in the jet is determined. (4 refs.) *A.J.B.*

41.10H Electromagnetic waves: theory

71061 Far field radiation patterns of elliptical apertures and its annuli. Y.P.Kathuria (Inst. for Appl. Phys., Darmstadt, Germany).
Opt. Appl. (Poland), vol.12, no.3-4, p.411-17 (1982).
A Fourier transform technique is used to derive expressions for the diffraction field due to elliptical apertures and its annuli. Perspective plots of the intensity distribution diagrams are generated for various values of the axis-ratio with the help of IBM-370/168 computer. All possible cases are discussed briefly. (12 refs.)

71062 A numerical analysis of electromagnetic scattering of perfect conducting cylinders by means of discrete singularity method. M.Nishimura (Maizuru Tech. Coll., Maizuru, Japan), H.Shigesawa.
Trans. Inst. Electron. & Commun. Eng. Jpn. Part B (Japan), vol.J66B, no.2, p.245-52 (Feb. 1983). In Japanese.
A computation technique of electromagnetic wave scattering from perfect conducting cylinders with arbitrary cross sections is described. To express the two dimensional scattering wave, the present approach takes account of a set of the solutions of the Helmholtz equation of which singularities are distributed inside the scatterers. The least-squares criterion of the boundry conditions is considered to obtain the optimum scattering field. The validity of the present method is demonstrated in comparison with other methods. (16 refs.)

Note on 'Spin-weighted spherical harmonics and electromagnetic multipole expansions' ....See Entry 69826

The 'missing' electromagnetic wave and the additional boundary conditions for light in a crystal ....See Entry 72756

41.70 PARTICLES IN ELECTROMAGNETIC FIELDS: CLASSICAL ASPECTS

(inc. synchrotron radiation)

The electrodynamics with magnetic monopoles. II. Canonical formalism ....See Entry 69902

Dual symmetry in classical and quantum spin theory ....See Entry 70304

Nonlinear theory of the compression of a relativistic electron beam by coherent electromagnetic radiation ....See Entry 70732

Stationary states of a thin inhomogeneous electron beam in external fields ....See Entry 71065

41.80 PARTICLE BEAMS AND PARTICLE OPTICS

(see also 07.80 Electron and ion microscopy, 07.77 Beam handling equipment)

71063 Coherence of neutron fields. E.Ledinegg, E.Schachinger (Inst. fur Theoretische Phys., Tech. Univ. Graz, Graz, Austria).
Phys. Rev. A (USA), vol.27, no.5, p.2555-65 (May 1983).
Glauber's definition of quantum coherence is used for neutron fields under the assumption that the complete occupation number space is a direct product of Fermi subspaces. As a result, completely coherent microfields are obtained which define a density operator in full analogy to Glauber's P representation of boson fields. For better physical significance, a transformation from the P representation to a momentum representation is performed. It is proved that the second-order coherence function in this representation is equivalent to Wolf's second-order coherence function of a classical Dirac field. Finally, the results of the theory are used to calculate explicitly the second-order coherence function and the coherence time of an ideally collimated neutron beam. (13 refs.)

41.80D Electron beams and electron optics

71064 On aberration theory of the combined electromagnetic focusing cathode lenses. Zhou Li-wei, Ai Ke-cong, Pan Shun-chen (Beijing Inst. of Technol., Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.376-92 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The aberration theory of the combined electromagnetic focusing cathode lenses is described, and the two previous representative papers concerning the aberration theory of cathode lenses, the first contributed by Ximen Jiye (1957) and next by B.E. Bonschtedt (1964), are emphatically analyzed and commented. It is shown that the formulae of aberration coefficients for the cathode lenses given by them, although different in form, can be transformed from one to another; and it is enough to prove that the criticism of B.E. Bonschtedt addressed to Ximen Jiye is improper. It is worth noticing that the aberrations of cathode lenses must be considered at the image plane with regard to $\varepsilon_{z(1)}$—a certain initial energy of electron in axial direction, then the formulae of all the transverse aberrations including the first order and third order aberrations for the combined electromagnetic focusing cathode lenses can be derived. It is expected that these formulae will be closer to practice than those derived formerly. (10 refs.)

71065 Stationary states of a thin inhomogeneous electron beam in external fields. A.S.Chikhachev.
Fiz. Plazmy (USSR), vol.9, no.2, p.378-82 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The behaviour of a high-current charged electron beam in longitudinal electric and magnetic fields in a paraxial approximation is studied. For a description of a beam with strong intrinsic fields a self-consistent model is used which is described by an invariant characterising the transverse motion of particles in the beam. (4 refs.) *A.G.C.*

Continuous-running electron gun with a large-area plasma cathode ....See Entry 70152

Electron beam blanking systems ....See Entry 70156

42.00 OPTICS

(for properties of gases and of liquids and solids, see 51.70 and 78. respectively; for atmospheric optics, see 92.65; for physiology of the eye, see 87.32)

42.10 PROPAGATION AND TRANSMISSION IN HOMOGENEOUS MEDIA

71066 Identification of stratified media based on the Bremmer series representation of the reflection coefficient. H.Kaiser (Sektion Maths. Phys., Paedagogische Hochschule Karl Liebknecht, Potsdam, Germany).
Appl. Opt. (USA), vol.22, no.9, p.1337-45 (1 May 1983).
The identification method is based on approximations of the reflection coefficient r by terms of the Bremmer series. One of these supplies an explicit representation of the refractive-index profile n, utilizing the Fourier transform $\mathfrak{F}r$ of r. Various procedures for the identification of thin-film systems using fast Fourier transform are derived from this relationship between $\mathfrak{F}r$ and n. One main issue of this paper is the determination of jumps within the refractive-index profile. For this purpose a numerical representation of $\mathfrak{F}r$ is subjected to waveform analysis. Theoretical and algorithmic aspects of the method are investigated, including a critical discussion in connection with numerical experiments. (6 refs.)

71067 Light scattering by horizontally oriented spheroidal particles. S.Asano (Meteorological Res. Inst., Ibaraki-ken, Japan).
Appl. Opt. (USA), vol.22, no.9, p.1390-6 (1 May 1983).
Light scattering properties of spheroidal particles oriented randomly with their long axes in the horizontal are studied. A computational scheme has been developed to calculate the scattering matrices as well as the extinction

and scattering cross sections and asymmetry factors in a manner consistent with previous treatment of 3-D orientations. The single scattering properties strongly depend on the elevation angle of incident light. The dependence of the extinction and scattering cross sections is particularly prominent, while the dependence of the single scattering albedo and asymmetry factor is rather small but still significant. For a given elevation angle, the scattering intensity is a function of not only the scattering angle but also the azimuth angle of emergence. Implications of the anisotropic scattering by horizontally oriented nonspherical particles with respect to the elevation angle are also discussed. (20 refs.)

71068 Lambert scattering from a hyperboloid of one sheet. F.A.Spagnolo (Central Intelligence Agency, Washington, DC, USA), J.J.Segedy.
Appl. Opt. (USA), vol.22, no.9, p.1397-401 (1 May 1983).
A generalized vector-matrix method is employed to determine the intensity of diffusely scattered light from a hyperboloid of one sheet. Solutions for both the elliptic and circular cross-section cases are obtained in integral form. For certain limiting conditions the latter results are shown to reduce to a form obtained earlier for a cylinder of circular cross section. (8 refs.)

71069 Mathematical analysis of gratings with circularly concentric grooves. J.M.Elson (Phys. Div., Naval Weapons Center, China Lake, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.702-6 (May 1983).
A mathematical method of analysis of gratings having circularly concentric grooves is presented. The main emphasis is not on the ultimate calculation of the diffracted or scattered fields but rather on reducing the problem to a tractable form with clear physical interpretation, to which the point-matching method can be applied. This is done by starting with the Rayleigh-Fano equation for scattering from rough surfaces. For circular geometry, the problem initially appears intractable. However, by a series of Laplace and inverse Laplace transforms, the problem is reduced to a tractable form. (5 refs.)

71070 Coherence of light scattered by a random phase screen. V.N.Lakhin, R.Yu.Orlov, A.S.Chirkin, F.M.Yusubov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.290-3 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.493-7 (Sept. 1982). [received: May 1983]
The authors present results of near-field measurements of the transverse spatial correlation functions of the field scattered by a random phase screen. These measurements contain more detailed information about the scattering object than does the pattern in the far scattering field. The experimental data are interpreted with the help of the theory developed, taking into account the finite transverse sizes of the phase screen inhomogeneities. (8 refs.)

Theory of partial coherence. A bibliography for the period 1976-1980 .... See Entry 69811

Polarized double-slit diffraction .... See Entry 69835

Measurement of refractive index in transparent plates with a piece of paper and a laser source .... See Entry 69839

Laser beam deflection by thermal gradient .... See Entry 69844

More about the interference colours .... See Entry 70103

Diffraction imagery of a degraded edge object in presence of image motions .... See Entry 71083

Separation of the absolute retardation fringes by using polarizing holography .... See Entry 71087

Numerical method for the calculation of the light intensity distribution in the holographic image .... See Entry 71091

The self-injected nonmode-locked picosecond laser .... See Entry 71141

Properties of *Q* switches with partial polarizers .... See Entry 71143

Changes in the polarization structure of laser radiation by lens systems .... See Entry 71168

Scattering theory of distortion correction by phase conjugation .... See Entry 71190

Optical polarizers for the ultraviolet .... See Entry 71223

Effect of axial misalignment and multiple reflection on Jones matrix of a four crystal light modulator .... See Entry 71228

Wave scattering and guidance by dielectric waveguides with periodic surfaces .... See Entry 71229

Hamiltonian analysis of beams in an optical slab guide .... See Entry 71231

Microbending effects on monomode light propagation in multimode fibers .... See Entry 71238

Diffraction of light in magnetooptic media with a band domain structure .... See Entry 72774

42.20 PROPAGATION AND TRANSMISSION IN INHOMOGENEOUS MEDIA

71071 Wave-front dislocations: topological limitations for adaptive systems with phase conjugation. N.B.Baranova, A.V.Mamaev, N.F.Philipetsky, V.V.Shkunov, B.Ya.Zel'dovich (Inst. for Problems in Mech., Acad. of Sci., Moscow, USSR).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.525-8 (May 1983).
The density of wave-front dislocations for optical fields as a function of radiation parameters is investigated both theoretically and experimentally. A field with dislocations cannot be conjugated by means of flexible adaptive mirrors. (7 refs.)

71072 Albedo for an inhomogeneous half space. S.A.El Wakil, M.T.Atia, M.H.Haggag (Phys. Dept., Mansoura Univ., Mansoura, Egypt), E.S.Saad.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.451-6 (May 1983).
The albedo is calculated for an inhomogeneous half-space by assuming that the single scattering albedo behaves like $c(z)=c_0e^{-(z/s)}$. The modified Eddington method is used to obtain the outgoing flux and hence the albedo. Numerical calculations and comparisons with Pomraning et al. (1980) and with an improved version of the F_N- method indicate that the approach is reasonably accurate. (23 refs.)

71073 Determination of the real part of relative refractive-index of spherical particles using scattering-matrix components. E.K.Naumenko, T.V.Oleinik, A.Ya.Khairullina.
Opt. & Spectrosc. (USA), vol.53, no.3, p.288-90 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.489-92 (Sept. 1982). [received: May 1983]
Measurement methods are proposed for the real part of the refractive index of soft spherical particles modeling blood cells and chloroplasts. They are based upon the determination of those angles at which the scattering-matrix elements $f_{33}(n,\kappa,\rho_0,\gamma)=0$ and $f_{34}(n,\kappa,\rho_0,\gamma)=0$. The methods are applicable within the range of values $n=1.02\text{-}1.15$. The relative error of determination of $(n-1)$ does not exceed 15%. (15 refs.)

71074 Statistical screening and the solution of inverse problems. V.A.Krutikov, A.A.Nalivaiko.
Opt. & Spectrosc. (USA), vol.53, no.3, p.293-5 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.498-500 (Sept. 1982). [received: May 1983]
Results are presented of calculating the spectral density fuction of the log-intensity fluctuations for a system of large-scale inhomogeneities in the statistical screening approximation, as well as of numerical modeling of the reconstruction of the distribution function of scattered sizes with an accuracy that is sufficient for practical purposes. (11 refs.)

71075 Effects of partial wave-front reversal during the reflection of waves in randomly inhomogeneous media. Yu.A.Kravtsov, A.I.Saichev (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.291-4 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.532-8 (Aug. 1982). [received: May 1983]
The effect of partial reversal of the wavefront during the reflection of a wave in a randomly inhomogeneous medium is discussed in detail. It is noted that the presence of the reversed component in the field of the reflected wave leads to the appearance of long-range correlations of the reflected field and the enhancement of the mean intensity of the reflected wave in the focal plane of a lens. (10 refs.)

Light scattering by horizontally oriented spheroidal particles .... See Entry 71067

Probability distribution of photocounts of the light scattered by critical fluctuations .... See Entry 71096

Measurements of visual light scattering in glass electrets .... See Entry 72823

Light gradients in plant tissue .... See Entry 73631

Application of the 2-D discrete-ordinates method to multiple scattering of laser radiation .... See Entry 73922

42.30 OPTICAL INFORMATION, IMAGE FORMATION AND ANALYSIS

71076 Set of orthogonal primary aberration coefficients. D.Malacara (Centre de Investigaciones en Optica, AC, Leon, Mexico).
Appl. Opt. (USA), vol.22, no.9, p.1273-4 (1 May 1983).
A set of coefficients in terms of Zernike polynomials *Umm* is described in which the aberrations are represented by their magnitude and orientation in the *x-y* plane. Expressions are presented for wavefront tilt, defocusing, third-order astigmatism, third-order coma, triangular astigmatism, spherical aberration, quadratic astigmatism, and fifth-order astigmatism. The coefficients are useful in the evaluation of interferograms in optical testing. (4 refs.)

71077 Derivation of the point spread function. H.F.A.Tschunko (NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Appl. Opt. (USA), vol.22, no.9, p.1413-14 (1 May 1983).
The derivation of the point spread function in general uses the mathematical theory of diffraction in detail. This derivation uses geometric relations of the incoming and diffracted wave front to establish the diffraction integral, which is equal to the Hankel integral for the Bessel function of the first kind of order one. (7 refs.)

71078 High-speed optical Fourier transformer. T.Kobayashi (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan), H.Ibe, S.Fujimoto, A.Morimoto, T.D.Sueta.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.674-9 (April 1983).
A new type of high-speed signal processing or analyzing device—the picosecond Fourier transformer—is proposed. The device can be used to obtain the Fourier transform of the time-dependent intensity of an optical signal. The device makes use of the spatially distributed electrooptic modulator or deflector, and has the potential for terahertz bandwidth and picosecond time resolution. Practical devices are considered and their performance (bandwidth, frequency resolution, etc.) are discussed. The operation of the proposed device is demonstrated in the microsecond range by a preliminary experiment using $LiTaO_3$ e-o deflectors. (13 refs.)

71079 Aberration-free nonparaxial self-imaging. Y.Cohen-Sabban, D.Joyeux (Inst. d'Optique, Univ. de Paris-Sud, Orsay, France).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.707-19 (May 1983).
The fields diffracted by planar one- or two-dimensional periodic objects, and in particular their Fourier and Fresnel self-images, can be computed with the aid of a ray-tracing technique based on the Fermat principle. This method (geometrical self-imaging) yields accurate results for any numerical aperture and image field. An analytical study of the image formation, carried out in the fourth-order approximation of the phase, leads to the definition of self-imaging aberrations. These aberrations are strongly dependent on spatial frequency and render the well-known relationships derived by Rayleigh for the location and magnification of self-images approximate at best. The aberrations can be described graphically by a phase diagram and a magnification diagram, which permit interpretation of the properties of high-aperture, large-field self-images and the prediction of optimal imaging conditions. In the case of large magnifications (100× and larger) the authors present a simple method to eliminate all fourth-order aberrations completely and even sixth-order ones partially. This method consists of introducing a compensating spherical aberration to the incident wave, e.g. by the insertion of a glass plate of appropriate index and thickness just before the object. Thus object spatial frequencies up to about 900 mm^{-1} can be imaged almost without aberration for several image periods. (21 refs.)

71080 The fundamental experiments on optical information processing [with laser diode]. Y.Kajiki, K.Matsushita, E.Shimizu (Dept. of Electrical Engng., Osaka City Univ., Osaka, Japan).
Mem. Fac. Eng. Osaka City Univ. (Japan), vol.23, p.25-37 (Dec. 1982). [received: May 1983]
Describes the fundamental characteristics of the GaAlAs laser diode, for example, temporal coherence and spatial coherence, which are examined by interferometric method, optical Fourier transformation and optical correlation. (4 refs.)

71081 The development of a system theory for telecommunications, optics and cybernetics. H.Marko (Tech. Univ., Munchen, Germany).
NTG-Fachber. (Germany), vol.84, p.295-306 (1983). In German. (Neue Aspekte der Informations- und Systemtheorie (New Aspects of Information and System Theory), Garmisch-Partenkirchen, Germany, 23-25 March 1983).
Explains that a single dimensional system theory was originally developed from the operational calculus to solve linear differential equations. By reason of the superposition principle the transmission of a signal can be described in two different ways; either by a process of convolution in the time domain or

by a multiplication in the spectral domain. The author emphasizes the analogy between single and multidimensional systems to be observed generally in physics and biology. By multidimensional system theory these systems can be very simply and efficiently described. The author cites as examples the calculation of coherent optical wave fields and the derivation of a cybernetic model for the threshold of visual perception. After discussing in detail one, two, and three dimensional systems, the author concludes that functional transformation methods and Fourier transforms in particular, are a useful means for describing such systems. (9 refs.) *G.W.*

71082 An analysis of optical superresolution based on system theory. H.Platzer, H.Marko (Tech. Univ., Munchen, Germany).
NTG-Fachber. (Germany), vol.84, p.307-13 (1983). In German. (Neue Aspekte der Informations- und Systemtheorie (New Aspects of Information and System Theory), Garmisch-Partenkirchen, Germany, 23-25 March 1983).
Shows how the problem of superresolution can be dealt with by system theory. For this purpose the following topics are discussed: the transfer function of space; locally limited image signals; the classical experiment of Wolter and its computer simulation; prolate spheroidal functions and the principle of superheterodyne image formation. The ideas and the results of investigations mentioned here suggest that superresolution is not a promising process since a superresolving process must penetrate the near-zone. (8 refs.) *G.W.*

71083 Diffraction imagery of a degraded edge object in presence of image motions. A.Chandra, R.N.Singh, K.Singh (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
Opt. Appl. (Poland), vol.12, no.3-4, p.303-15 (1982).
Diffraction images of an incoherently illuminated degraded edge in the presence of image motions have been studied theoretically. The degrading effects of transverse and longitudinal sinusoidal vibrations and linear and parabolic image motions have been studied separately. The intensity distribution in the diffraction images has been calculated using the transfer function approach, and the results have been presented graphically. It is shown that consideration of the edge degradation effect is more important where the effects of various types of image motions on the performance of optical systems are to be evaluated. (32 refs.)

71084 Imaging of a two-point object in an apodized optical system. Theory and analog examination. A.Magiera, M.Pluta (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.363-77 (1982).
The influence of chosen types of amplitude apodizers on the two-point object imaging in one- and two-dimensional optics systems with axial symmetry has been examined. The authors propose an analog method for examining apodisation properties by simulating the convolution in a noncoherent optical processor. (7 refs.)

71085 Minimization of the second moment of the image intensity distribution. A.Magiera (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.474-82 (1982).
Presents an algorithm for determining a generalized pupil function minimizing the second moment of the intensity distribution in the image for a fixed value of energy transferred through the optical system with spherical aberration. (5 refs.)

Identification of stratified media based on the Bremmer series representation of the reflection coefficient ....See Entry 71066

Effect of convergence acceleration of a series describing the wavefront phase on the accuracy of the hologram aberration estimation ....See Entry 71090

Numerical method for the calculation of the light intensity distribution in the holographic image ....See Entry 71091

Meridional light path function and coma transfer for corrected holographic concave gratings ....See Entry 71092

Holographic imaging of a sinusoidal test ....See Entry 71093

Probabilistic cluster labeling of imagery data ....See Entry 73917

Edge and line detection in multidimensional noisy imagery data ....See Entry 73918

42.40 HOLOGRAPHY

(for acoustic holography, see 43.63)

71086 Augmented laser scan equations for lenticular or holographic elements. L.Beiser (Leo Beiser Inc., Flushing, NY, USA).
Appl. Opt. (USA), vol.22, no.9, p.1264-5 (1 May 1983).
It is shown that augmentation exists even when the scanning element exhibits optical power independently of being over or underilluminated. While this may not develop in conventional polygon scanners, for lenticular elements are seldom actively scanned, it can become significant in holographic scanning when such optical elements are integral with the scan device. A scanning positive lenticular element is considered first in translation along the x axis and then in arced motion constrained a distance r from the fulcrum. (7 refs.)

71087 Separation of the absolute retardation fringes by using polarizing holography. Wang Ji-zhong, Zhang Wen-zhi (Shandong Engng. Inst., China).
Acta Mech. Solida Sin. (China), no.3, p.352-7 (1981). In Chinese.
With this method Nisida's pattern and the two-family absolute retardation fringes can be directly observed through a single double-exposure hologram. If a linear polarizer is placed between the hologram and the observer, while the polarizer is being rotated, the absolute retardation fringes on those points where the transmission axis of the polarizer is parallel to a principal stress can also be observed, so that the two family absolute retardation fringes can be separated accurately in the whole model. The general expression for the light intensity of the reconstructed virtual image through the polarizer is derived by using Jones vector and matrix calculus. Finally experimental results are presented. (9 refs.)

71088 Fringe benefits: applications of holographic elements. T.Mikes (American Holographic Inc., Acton, MA, USA).
Photonics Spectra (USA), vol.17, no.3, p.40-4 (March 1983).
The performance features of holographic optical elements can best be shown through the example of a simple holographic diffraction grating. Some of the major applications of interference-type holographic optical elements are listed. The wideband applications are as optical components in spectroscopy and for fiber optics. The narrowband applications, in league with lasers, include holographic notch filters, hologon scanners, beamsplitters, head-up displays and microposition encoders. (3 refs.)

71089 Real-time holography and wave-front conjugation by stimulated scattering. A.I.Sokolovskaia, G.L.Brekhovskikh, A.D.Kudriavtseva (Acad. of Sci., P.N. Lebedev Phys. Inst., Moscow, USSR).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.554-7 (May 1983).
Wave-front reconstruction (conjugation) by stimulated scattering has been shown experimentally to occur in the presence of two processes: (1) a directed scattered wave forming in the volume near the focus of a lens; (2) stimulated scattering amplification and diffraction from the amplifying amplitude hologram near the entrance window of the cell. Stimulated scattering saturation in the volume, playing the role of a dynamic hologram, lead to the breakdown of the reconstruction (conjugation) effect. The diffraction efficiency of the dynamic holograms for stimulated scattering has been measured. The influence of self-focusing on wave-front reconstruction (conjugation) by stimulated scattering is discussed. (14 refs.)

71090 Effect of convergence acceleration of a series describing the wave-front phase on the accuracy of the hologram aberration estimation. G.Mulak (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.341-52 (1982).
Taking as an example an axial hologram recorded and reconstructed under the condition of limit of resolution, the influence of the convergence acceleration of a series describing the wavefront phase on the convergence rate and thus on the accuracy of the aberration determination has been considered. Spherical aberration, coma and field curvature have been chosen for considerations, since they illustrate some extreme situations. It is shown that the acceleration of series convergence is associated with a change in error distribution among the constant term of the expansion, the Gaussian sphere component and the rest responsible for the aberrations. (4 refs.)

71091 Numerical method for the calculation of the light intensity distribution in the holographic image. J.Nowak, M.Zajac (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.353-61 (1982).
The imaging quality may be estimated through the evaluation of the aberration spot which is an imperfect image of the point object. In classical optics the aberration spot shape is calculated with the help of the 'ray tracing' method. In holographic imaging, however, it must be remembered that the light used for image reconstruction is coherent. The authors present an algorithm which enables one to calculate the light intensity distribution in the holographic image of a point object and discuss the accuracy of the results obtained. (6 refs.)

71092 Meridional light path function and coma transfer for corrected holographic concave gratings. R.Guther (Central Inst. for Optics & Spectroscopy, Acad. of Sci., Berlin-Adlershof, Germany).
Opt. Appl. (Poland), vol.12, no.3-4, p.451-60 (1982).
Calculates the general form of the light path function for corrected holographic concave gratings in the meridional cut up to the third order in the transverse grating coordinate, using both aspheric wavefronts and aspheric grating supports for a grating record. From this light path function one obtains a formula which describes the change of the third order part (comatic part) of the incident wavefront by the grating. Together with the focusing properties of the grating this gives the possibility of treating optical systems containing gratings. (7 refs.)

71093 Holographic imaging of a sinusoidal test. J.Nowak (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.471-3 (1982).
Examines the influence of particular aberrations on the image contrast of an object given in the form of an amplitude sinusoidal test. As is well known in a coherent system, a transfer function for both the contrast and phase cannot be defined in a way analogous to that used in incoherent optical systems. Under certain assumptions, however, it is possible to define the degradation of contrast in the image with respect to that present in the object. (3 refs.)

71094 Three dimensional images. J.Bulabois, G.Tribillon (Faculty of Sci. & Tech., Besancon, France).
Recherche (France), vol.14, no.144, p.638-46, 649 (May 1983). In French.
Three dimensional images have always been an attraction. In 1948 D. Gabor discovered the principles of holography. 20 years later, with lasers available, holographic progresses have speeded up very considerably. The paper is an appreciation of the present position. The development of photography from the very early days is described, leading up to the discovery of holography. The method in which relief is obtained, using lasers, is explained. Diagrams are given to explain the basics of holography, in a very simple manner. There is an accompanying explanation and then follows a description of progress made from fixed to moving objects. The uses of three dimensional images for medical work are explained and the use of images in natural light. Vision not apparent to the eye is outlined and there is a brief glimpse into the future. (5 refs.) *G.V.D.*

71095 Investigation of influence of polarizing radiation scattered by an optically inhomogeneous layer on its holographic image quality. V.K.Polyanskii, A.G.Ushenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.511-14 (April 1983). In Russian.
Statistical light scattering effects on restored holographic image brightness characteristics are investigated for optically inhomogeneous layers. It is shown that it is possible to control the brightness in their images. (9 refs.)

Plasma formation in a gas-liner pinch ....See Entry 71773

Study of the temperature field in a vertical cold wall reactor by holographic interferometry [CVD] ....See Entry 72997

Flaw detection on inhomogeneities in dielectrics by radioholography ....See Entry 73299

42.50 QUANTUM OPTICS

71096 Probability distribution of photocounts of the light scattered by critical fluctuations. S.H.Chen (Nuclear Engng. Dept., MIT, Cambridge, MA, USA), C.C.Lai, J.Rouch, P.Tartaglia.
J. Stat. Phys. (USA), vol.30, no.3, p.699-707 (March 1983).
The probability distribution of photocounts $P(n, T)$ of the light scattered by concentration fluctuations in a binary system near the critical point has been measured. The results turn out to be consistent with the theoretical predictions for Gaussian-Lorentzian light. (18 refs.)

71097 On coherence in spontaneous emission. F.W.Cummings, A.Dorri (Dept. of Phys., Univ. of California, Riverside, CA, USA).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.263-5 (2 May 1983).
The case of a single excited two-level atom emitting spontaneously in the presence of N unexcited atoms is solved exactly for emission into a single electromagnetic mode. The two-level atoms are in inequivalent mode positions. (5 refs.)

71098 Validity of Rosen-Zener conjecture for Gaussian-modulated pulses. G.F.Thomas (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada).
Phys. Rev. A (USA), vol.27, no.5, p.2744-6 (May 1983).
Using the Magnus approximation the author shows that the Rosen-Zener conjecture holds for a two-level system in near-resonant interaction with a Gaussian-modulated pulse of sufficiently short duration. (12 refs.)

71099 Kinetic equation for a two-level system interacting with the electromagnetic field. N.N.Bogolyubov,Jr., Fam Le Kien, A.S.Shumovskii (Joint Inst. for Nuclear Res., Dubna, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.893-8 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.423-30 (Sept. 1982). [received: May 1983]
Bogolyubov's method (1974) is used to obtain a generalized kinetic equation for a dynamical system of two-level emitters interacting with the electromagnetic field. The problem of collective spontaneous emission is investigated by means of this equation with allowance for inhomogeneous Lorentz broadening. (41 refs.)

Coherence of neutron fields .... See Entry 71063

Photochemical xenon-oxide laser .... See Entry 71114

Optical properties of a GaAlAs superluminescent diode .... See Entry 71124

A model for superradiance and superfluorescence in free-electron lasers .... See Entry 71133

Measurement of the modal reflectivity of an antireflection coating on a superluminescent diode .... See Entry 71135

Reduction of angular momentum coupling trees and the polarization dependence of nonlinear optical processes .... See Entry 71175

42.52 MASERS

Masers and lasers. An historical approach .... See Entry 69805

A compact hydrogen maser with exceptional long-term stability [measurement standards] .... See Entry 70039

Population inversion in the spin states of photoelectrons and the spin-lattice relaxation in narrow-gap semiconductors .... See Entry 72672

Alfven sweep-maser .... See Entry 73959

42.55 LASING PROCESSES

Masers and lasers. An historical approach .... See Entry 69805

Laser processing and analysis of materials .... See Entry 69807

42.55B General theory of lasing action

71100 A novel numerical model for passively mode-locked solid-state lasers. A.Leitner, M.E.Lippitsch (Inst. fur Experimentalphys., Karl-Franzens-Univ. Graz, Graz, Austria), E.Roschger, F.R.Aussenegg.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.562-6 (April 1983).
Numerical computer models could be of high value in testing ideas for improving passive mode locking. Most of the known models for solid-state lasers lack realistic quantitative results, however. A new model is presented, using a rate-equation approach which has been refined to include interference effects by using field amplitudes and phases instead of energies. Also, the saturable absorber is treated by rate equations. With this model, a rather complete description of the pulse evolution is possible. The influence of various parameters on the mode-locking quality is calculated. The model is also capable of reliably describing processes based mainly on interference effects, like the action of external subresonators. (16 refs.)

71101 Saturation effects in phase-conjugate lasers. A.Hardy, Y.Silberberg (Dept. of Electronics, Weizmann Inst. of Sci., Rehovot, Israel).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.594-9 (May 1983).
Phase-conjugate lasers with saturable gain medium are analyzed, taking into account the saturation of the reflectivity of the phase-conjugate mirror that is due to pump depletion. It is shown that the behavior of the laser is determined by the extent to which the reflectivity is saturated as compared with the saturation of the gain medium. For weakly saturated phase-conjugate mirrors, the intensities and gain are not much different from those in conventional lasers. For strongly saturated mirrors, the laser behaves more like a single-pass amplifier with output intensity proportional to the pump intensity of the phase-conjugate mirror. (18 refs.)

71102 Power and stability of phase-conjugate lasers. T.J.Karr (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.600-9 (May 1983).
The phase-conjugate laser (PCL) is analyzed as a network of energy flow with gain, saturation, and loss. Most PCLs fit into one of the three generic forms of energy coupling, defined by how the phase-conjugate mirror is pumped. The self-pumped PCL is a nonlinear feedback system with constraints not present in ordinary lasers. The internal and external powers are roots of a transcendental function that includes arbitrary gain and saturation. The PCL's are compared for useful output power with an ordinary laser of the same gain/loss. Most PCLs have maximum output as double-pass amplifiers (weak feedback and high extraction). The externally pumped PCL is inherently inefficient except at high gain. The self-pumped PCLs are efficient at high and low gain and are multistable optical devices with discrete power levels. The multistability is generic and does not depend on any specific form of the reflectance function. The higher states have not been seen experimentally because they cannot develop from the lowest state but must be induced by hard excitation of the PCL. (21 refs.)

71103 On the critical length of a laser. G.Stephan (Lab. de Spectroscopie, Univ. de Rennes, Rennes, France).
J. Phys. Lett. (France), vol.44, no.10, p.L361-8 (15 May 1983). In French.
The critical length of a laser has been introduced to explain a variation in the asymmetry of the line shape when the length of the cavity is varied. The author theoretically shows that this concept is a consequence of the mean field approximation which is not justified when the amplifying medium fills the entire cavity. It then appears that this variation of asymmetry is also related to the length of the amplifying tube. An exerimental verificiation of this result is given. (7 refs.)

71104 The laser: a reversible quantum dynamical system with irreversible classical macroscopic motion. K.Hepp (Dept. of Phys., ETH, Zurich, Switzerland), E.H.Lieb.
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.153-77
Describes a mathematical machine which behaves like a laser but which is much simpler than any laser found in the laboratory. The machine consists of two main parts: the first one, which is the laser proper, consists of atoms and photons which are the quantized proper vibrations of a resonant cavity. It is essential that the number, N, of atoms be allowed to become very large, but the number of different photon modes can be infinite or finite. This number can in fact be one in order for the machine to operate, but in real life the number of modes is infinite. One can handle the infinite mode case provided that essentially only a finite number of modes is macroscopically excited. The second part consists of reservoirs. They are dynamical systems which in some sense are infinitely large compared to N, and they are so constructed that they can both pump energy into and drain energy out of the laser. The energy flux from reservoir to laser is thoroughly chaotic. The laser can take this energy and structure it. In other words, the laser, when suitably coupled to the reservoir, will go into a cooperative oscillatory state in which all the N atoms and the photons vibrate coherently and periodically. (10 refs.)

Initiation of laser chemical reactions by automatic phase locking in stimulated Raman scattering in a molecular gas .... See Entry 71186

42.55D CO_2 lasers

71105 Influence of a counterpressure on the operation of a CO_2 gasdynamic laser emitting at 18.4 μ. A.A.Vedeneev, A.Yu.Volkov, A.I.Demin, E.M.Kudryavtsev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR), M.Brunne, J.Milewski, E.Stanco.
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1518-20 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2333-6 (Nov. 1982). [received: May 1983]
It was found experimentally that stimulated emission at $\lambda=18.4\ \mu$ was possible in a CO_2 gasdynamic laser with a supersonic stream escaping into space at a counterpressure up to 0.25 atm. (10 refs.)

Spectrograph for investigating spectra of pulsed infrared lasers .... See Entry 70128

Radio-frequency-excited carbon dioxide metal waveguide laser .... See Entry 71138

High-power continuously tunable atmospheric-pressure CO_2 laser operating in the superregenerative amplification regime .... See Entry 71142

Optically pumped FIR lasers phase-locked by Stark effect applied to precise optical frequency measurements .... See Entry 71162

Heterodyne analysis of laser modes .... See Entry 71166

42.55F Inert gas lasers

71106 Measurement of laser frequency stability. K.M.Abramski (Inst. Telekomunikacji Akustyki Politech. Wroclawskiej, Wroclaw, Poland).
Rozpr. Electrotech. (Poland), vol.27, no.4, p.1161-71 (1981). [received: May 1983]
A definition of the frequency stability of lasers in the frequency domain and in the time domain is given. Attention is paid to the necessity to connect frequency stability with averaging time. The results of measurements of He-Ne/CH_4 laser stability are reported. (14 refs.)

Mechanism of four-level laser action in solution excimer and excited-state proton-transfer cases .... See Entry 71117

The HeNe Laser: How to buy one. IV .... See Entry 71139

The HeNe laser: putting it all together. III .... See Entry 71140

Power characteristics of an He-Ne laser utilizing the $3s_2$-$2p_6$ transition in neon ($\lambda=612$ nm) and containing a $^{127}I_2$ absorption cell .... See Entry 71169

42.55H Lasing action in other gas lasers

71107 Measured gain for XUV plasma lasers at varying pump intensities. R.H.Dixon, J.F.Seely, R.C.Elton (US Naval Res. Lab., Washington, DC, USA).
Appl. Opt. (USA), vol.22, no.9, p.1309-12 (1 May 1983).
Inverted population densities are measured in a laser-produced carbon plasma and interpreted in terms of absolute gain coefficients in the 1%/cm range for potential amplification in the XUV at 52-nm wavelength. Scaling to higher gain through increased ionization at higher pumping intensities is attempted, and a factor of 2 enhancement is indicated. (17 refs.)

71108 Improved lasing performance of KrCl excimer laser. E.Armandillo, A.Luches, V.Nassisi, M.R.Perrone (Dipartimento di Fisica, Univ. di Lecce, Lecce, Italy).
Appl. Phys. Lett. (USA), vol.42, no.10, p.860-1 (15 May 1983).
A compact, small active volume (70 cc) discharge pumped KrCl laser with UV preionization is described. The results obtained show that KrCl compares well with the performance obtainable fropm the well established XeCl and KrF lasers. Considerably improved laser output energy density ($\approx$2.5 J/1) is achieved at very high discharge power loadings ($\approx$24 MW/cc), with a good power conversion efficiency (0.8%) and a long gas static lifetime. The output laser beam is reproducible and uniform with a cross section of 2×1 cm^2. (5 refs.)

71109 Thermal homogeneity in a closed excimer laser cavity. C.J.Knight (Avco Everett Res. Lab. Inc., Everett, MA, USA).
AIAA J. (USA), vol.21, no.4, p.541-9 (April 1983).
Thermal homogeneity in a single-pulse excimer laser cavity is of interest because it directly impacts medium optical quality. This study is primarily oriented toward an XeF* laser in which the cavity is hot (500K) and is pumped by an e-beam from a cold cathode structure in a vacuum chamber next to the cavity. The foil and support structure are on a vertical wall between these hot and cold zones. In consequence, due to radiative heat transfer, the wall assumes a nonuniform temperature and induces natural convection and thermal inhomogeneity within the cavity. Studies of radiative, conductive, and natural convective heat-transfer processes are summarized which leads to a plausible engineering approach to achieving medium homogeneity of $(\delta\rho/\rho)_{rms}\sim5\times10^{-5}$ in the closed XeF* laser cavity. (7 refs.)

71110 Spectral characteristics of carbon monoxide lasers with different isotopic compositions. V.I.Masychev, V.G.Plotnichenko, V.K.Sysoev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1494-6 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2303-6 (Nov. 1982). [received: May 1983]
The spectral characteristics of sealed carbon monoxide lasers with different isotopic compositions were investigated at room temperature. The emission spectra were recorded for three identical CO lasers filled with gas mixtures containing $^{12}C^{16}O$, $^{13}C^{16}O$, and $^{12}C^{16}O$-$^{13}C^{16}O$. In the case of lasers with nonselective resonators the number of emission lines in the 1893-1610 cm^{-1} range was 28-30 (for the mixture of isotopes it was 22). The emission spectrum of the laser filled with $^{13}C^{16}O$ was shifted by 40 cm^{-1} in the direction of lower frequencies compared with the spectrum of the $^{13}C^{16}O$ laser. (10 refs.)

71111 Possibility of laser emission from excimers and exciplexes of aromatic compounds. S.A.Krashakov, B.M.Uzhinov (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1521-3 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2336-9 (Nov. 1982). [received: May 1983]
An analysis is made of the possibility of laser emission from excimers and exciplexes of aromatic compounds. The cross section for stimulated emission from excited particles is used as the main criterion. Approximate estimates indicate that the lower limit of this cross section for compounds known to exhibit laser emission is $(3\text{-}5)\times10^{-17}$ cm^2. In the case of excimers and exciplexes of aromatic compounds examined in the present paper this cross section is an order of magnitude less. It follows that lasing of typical intermolecular and intramolecular excimers and exciplexes is not very likely. (38 refs.)

Laser studies of electronic energy transfer in atomic copper ... See Entry 70807

Oscillatory continuum emission from Br_2 following vacuum ultraviolet laser excitation .... See Entry 70934

Pulse compression by pulse-stacking in a KrF amplifiers .... See Entry 71146

Optically pumped FIR lasers phase-locked by Stark effect applied to precise optical frequency measurements .... See Entry 71162

Heterodyne analysis of laser modes .... See Entry 71166

Transportation of far-IR bemas for use in plasma diagnostics .... See Entry 71790

42.55K Chemical lasers

(see also 82.40T Chemiluminescence and chemical laser kinetics)

71112 Gain anisotropy in low-pressure chemical lasers. H.Mirels (Aerophys. Lab., Aerospace Corp., Los Angeles, CA, USA).
Appl. Opt. (USA), vol.22, no.9, p.1281-3 (1 May 1983).
The gain coefficient in a low-pressure chemical laser during lasing differs when viewed along the optical resonator axis and when viewed normal to the axis. Expressions for axial and normal gain coefficients are deduced. The ratio of normal-to-axial gain coefficient is evaluated for a saturated multimode chemical laser employing a Fabry-Perot resonator. The results are useful for correlating numerical code calculations with experimental power on gain measurements made normal to the optical axis. (5 refs.)

71113 On the regeneration mechanism of $HgBr_2$ in $HgBr/HgBr_2$ dissociation lasers. A.C.Erlandson, T.A.Cool (School of Appl. & Engng. Phys., Cornell Univ., Ithaca, NY, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.685-9 (29 April 1983).
The fast bimolecular reaction $HgBr+Br_2 \rightarrow HgBr_2+Br$ is shown to be responsible for the observed rapid and efficient regeneration of $HgBr_2$ in cyclic operation of the repetitively pulsed HgBr photodissociation laser. The rate constant for this reaction has been measured to be $(7.7\pm0.6)\times10^{-11}$ cm^3 molecule^{-1} s^{-1} at 415K. (11 refs.)

71114 Photochemical xenon-oxide laser. V.S.Zuev, L.D.Mikheev, I.V.Pogorel'skii.
J. Sov. Laser Res. (USA), vol.4, no.1, p.1-31 (Jan.-Feb. 1983).
Theoretical and experimental investigations are described, aimed at the development, construction, and study of the features of a photochemical xenon-oxide laser whose action is based on the photodecomposition of nitrous oxide by vacuum ultraviolet radiation of an open high-current discharge with formation of oxygen atoms followed by oxidation of the xenon. The theoretical problems connected with the determination of the mechanism and the calculation of the kinetics of the physicochemical processes in an XeO laser are considered. A numerical computation of the pumping is carried out, and the inversion and gain on the laser transition are calculated. The construction of the laser is described, as well as an experimental procedure for obtaining the optimal temperatures, composition, and pressure of the working-mixture components. (49 refs.)

Possibility of separating the isotopes ^{127}I and ^{129}I with the aid of a photodissociation iodine laser .... See Entry 71029

Passive mode locking in iodine photodissociation laser .... See Entry 71167

Possibility of using recombination reactions and alkali metals to obtain inversion on atomic iodine .... See Entry 73330

Photolysis of compounds with P-I and As-I bonds .... See Entry 73348

Photodissociation of the molecules $SiCl_3I$ and SiF_3I .... See Entry 73349

Possibility of lasing in the visible band by molecule photodissociation .... See Entry 73350

Reactions of excited $I^*(^2P_{1/2})$ and unexcited $I(^2P_{3/2})$ iodine atoms in perfluoroalkyl radicals .... See Entry 73351

42.55M Lasing action in liquids and organic dyes

71115 Optical absorption spectrum of Pr^{3+} in aprotic $POCl_3$:$SnCl_4$ laser liquid. S.V.J.Lakshman, L.R.Moorthy (Dept. of Phys., S.V. Univ., Tirupati, India).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.439-44 (May 1983).
Spectral studies of Pr^{3+} in aprotic $POCl_3+SnCl_4$ laser liquid have been carried out in the visible and near IR regions. From the observed band positions, the Slater-Condon (F_2, F_4, and F_6) configuration interaction (α,β), spin-orbit (ξ_{4f}), nephelauxetic (β), bonding (δ), and Judd-Ofelt (T_2, T_4 and T_6) intensity parameters are evaluated. From the splittings of the $^3P_2$ and $^1D_2$ bands, crystal field (A_{20}, A_{40}) parameters were evaluated assuming C_{3h} symmetry for Pr^{3+} in $POCl_3$:$SnCl_4$ laser liquid. Theoretical estimates of spectral intensities calculated from Judd-Ofelt and electric (S_{ed})-magnetic (S_{md}) dipole line-strength methods are in good agreement with the observed values. Radiative lifetimes (T_R) for the electronic excited states $^3P_1$, $^3P_0$ and $^1D_2$ of Pr^{3+} in $POCl_3$:$SnCl_4$ laser liquid are predicted. (17 refs.)

71116 Laser emission from the dye mixture solution pumped by a N_2 laser. M.Terada, K.Miwa, Y.Ohba (Dept. of Instrumentation, Keio Univ., Yokohama, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1301-3 (Nov. 1982). In Japanese. [received: March 1983]
Laser emission from perylene in solution is obtained by means of energy transfer between 9-methylanthracene (donor) and perylene (acceptor). From the experimental result of the time-resolved fluorescence spectra and the Stern-Volmer relation of the dye mixture solution, the energy transfer is attributed to the dipole-dipole interaction. Laser power from the dye mixture solution is measured at various concentrations of donor and acceptor. At the optimum concentrations, the laser power from the mixture solution is about six times larger than that of the perylene solution. (7 refs.)

71117 Mechanism of four-level laser action in solution excimer and excited-state proton-transfer cases. A.U.Khan, M.Kasha (Dept. of Chem., Inst. of Molecular Biophys., Florida State Univ., Tallahassee, FL, USA).
Proc. Natl. Acad. Sci. USA, vol.80, no.6, p.1767-70 (March 1983).
Four-level laser energy level schemes are compared from the mechanistic spectroscopic viewpoint: (i) noble-gas excimer, (ii) solution molecular excimer, (iii) conventional dye laser, and (iv) intramolecular proton transfer. The lasing action of the chlorophyll special pair is discussed as an example of a solution excimer laser, and the lasing action of 3-hydroxyflavone and other molecules is discussed as an example of an intramolecular proton-transfer laser. (22 refs.)

Singlet energy transfer from the charge-transfer excited state of tris(2,2'-bipyridine)ruthenium(II) to laser dyes .... See Entry 70936

Synchronous amplification of subpicosecond pulses .... See Entry 71136

Improving the pulse shape in dye laser amplifiers: a new technique .... See Entry 71145

Pulse shaping in passively mode-locked ring dye lasers .... See Entry 71150

Calculation of the colliding pulse mode locking in CW dye ring lasers .... See Entry 71151

Compression mechanism of subpicosecond pulses by malachite green dye in passively mode-locked rhodamine 6G/DODCI CW dye lasers .... See Entry 71152

Single and double mode-locked ring dye lasers—theory and experiment .... See Entry 71153

Passive mode locking of flashlamp-pumped dye lasers in the 508-583 nm range .... See Entry 71154

Simultaneous determination of the spectral and temporal properties of tunable, single, picosecond pulses from a short cavity dye laser .... See Entry 71163

Pulse shortening in dye laser side-pumped by TEA N_2 laser ... See Entry 71164

Generation of tunable picosecond pulses in the ultraviolet and blue-green parts of the spectrum with the aid of a distributed-feedback dye laser .... See Entry 71187

42.55P Lasing action in semiconductors with junctions

71118 1.5-1.6-μm $Ga_{0.47}In_{0.53}As/Al_{0.48}In_{0.52}As$ multiquantum well lasers grown by molecular beam epitaxy. H.Temkin, K.Alavi, W.R.Wagner, T.P.Pearsall, A.Y.Cho (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.845-7 (15 May 1983)., p.A135-83011
The first successful preparations of optically pumped and current injection $Ga_{0.47}In_{0.53}As/Al_{0.48}In_{0.42}As$ multiquantum well lasers is reported. These devices, operating at room temperature in the 1.5-1.6-μm range, have been prepared by molecular beam epitaxy with well thickness as low as 80-90 Å and barrier thicknesses as low as 30 Å. In the broad area devices with a total active layer thickness of 0.14 μm the authors have observed a threshold current density as low as 2.4 kA/cm^2. (11 refs.)

71119 Short cavity InGaAsP/InP lasers with dielectric mirrors. U.Koren, Z.Rav-Noy, A.Hasson, T.R.Chen, K.L.Yu, L.Chiu, S.Margalit, A.Yariv (California Inst. of Technol., Pasadena, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.848-50 (15 May 1983).
Short cavity length (38 μm) lasers have been fabricated using a recently developed microcleavage technique. SiO_2-amorphous Si multilayer coatings have been evaporated on the lasers to obtain high reflectivity mirrors. The lasers have current thresholds as low as 3.8 mA with 85% reflecting front mirror and high reflectivity near mirror and 29 mA with two high reflectivity mirrors. Single longitudinal mode operation is observed over a wide range of driving currents and temperatures. (6 refs.)

71120 New large optical cavity laser with distributed active layers. W.T.Tsang, N.A.Olsson (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.850-2 (15 May 1983).
A new semiconductor current injection laser having multiple active layers distributed within a large optical cavity (LOC) waveguide is shown to operate as an efficient, low-threshold, high-peak power laser diode. The use of distributed active layers in LOC laser structure leads to improved efficiency in utilizing the injected carriers when compared to the conventional single active layer LOC laser structure. (6 refs.)

71121 A high-power, single-mode laser with twin-ridge-substrate structure. M.Wada, K.Hamada, H.Shimizu, T.Sugino, F.Tajiri, K.Itoh, G.Kano, I.Teramoto (Semiconductor Lab., Matsushita Electronics Corp., Osaka, Japan).
Appl. Phys. Lett. (USA), vol.42, no.10, p.853-4 (15 May 1983).
The structure of stripe-geometry lasers is reported in which a double heterostructure with a very thin active layer is fabricated on a substrate with two parallel ridges. It is shown that the structure is very much fitted for the high-power, single-mode oscillation. The maximum CW output obtained is approximately 100 mW/facet, which is the highest power output ever attained in fundamental transverse model devices. The far-field beam divergence parallel and perpendicular to the junction plane are as small as 6° and 16°, respectively. (11 refs.)

71122 Bistability and slow oscillation in an external cavity semiconductor laser. W.A.Stallard, D.J.Bradley (Laser Group, Phys. Dept., Trinity Coll., Dublin, Ireland).
Appl. Phys. Lett. (USA), vol.42, no.10, p.858-9 (15 May 1983).
Reproducible bistable and hysteretical behavior is obtained from an external cavity laser, with one absorbing and one gain semiconductor diode, when the absorber diode is operated below its transparency threshold current density. The laser diodes are optically coupled without parasitic conductance or photoconductive electrical coupling and the bistable laser operates in a single longitudinal mode. Under certain conditions the laser oscillates at around 20 Hz with millisecond optical switching times. (15 refs.)

71123 Temporal and spectral characteristics of rapidly gain-switched GaAs/GaAlAs buried-heterostructure lasers. G.Veith, J.Kuhl, E.O.Gobel (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Electron. Lett. (GB), vol.19, no.10, p.385-7 (12 May 1983).
The temporal and spectral output of GaAs/GaAlAs buried-heterostructure lasers under excitation with 60 ps electrical pulses is investigated for different DC bias conditions. Optical pulses comparable in width to the electrical pulses can be obtained only if the DC bias is below or close to threshold, where multimode emission is observed. For DC bias well above threshold the laser remains single-mode; however, the optical pulses are considerably broadened. (14 refs.)

71124 Optical properties of a GaAlAs superluminescent diode. N.K.Dutta, P.P.Deimel (Bell Labs., Murray Hill, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.496-8 (April 1983).
The optical properties of a GaAlAs superluminescent diode (SLD) are described. The spectra of this device exhibit a large number of longitudinal modes. The coupling efficiency into a 0.23 NA 50 μm diameter graded index fiber is $\sim$30 percent. The current required for constant light output at a temperature T can be written as $I(T) \sim I_o.\exp\ (T/T_2)$ where $T_2 \sim 120$K. A model of the SLD is described. (12 refs.)

71125 Growth and characterization of Cd-doped InGaAsP/InP double heterostructure lasers. N.Tamari (Bell Labs., Holmdel, NJ, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.611-29 (July 1982). [received: Nov. 1982]
The liquid phase epitaxial growth of Cd-doped InGaAsP/InP double heterostructure lasers (1.3 μm) has been studied. Cd has been found to have a smoothing effect on the morphology of the quaternary layers and a typical terracing effect on that of InP found also by doping with Zn. The defects, revealed by etching, were found to propagate in one to one correspondence from the substrate throughout the whole structure with no generation of defects even in a highly doped material. Electrical saturation at $p \sim 2 \times 10^{18}$ cm^{-3} was found in InP by Hall measurements while no saturation was found in the quaternary up to a hole concentration of $\sim 2 \times 10^{19}$ cm^{-3}. A lattice mismatch which is linearly dependent on the amount of Cd in the liquid was found to greatly facilitate the location of the p-n junction within the active region because of its low diffusion. Low threshold, very high external differential quantum efficiency, and high uniformity characterize the lasers made of this material. The results obtained in this work suggest that Cd should be considered as a promising candidate for a p-type dopant in fabrication of quaternary devices. (22 refs.)

71126 Stimulated emission from shallow donors localized by a strong magnetic field. H.J.A.Bluyssen (Res. Inst. for Materials, Univ. of Nijmegen, Nijmegen, Netherlands), L.J.van Ruyven.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.371-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
From measurements of the energy shift of the laser emission and the threshold current as a function of the magnetic field up to 25 T (DC) and at $T=9$K, localization of the shallow donors in the moderately doped ($\approx 10^{17}$ cm^{-3}) n-type active layer of a double heterostructure injection laser has been observed. A fit of the measured energy shift of the donor ground state as a function of the magnetic field with theoretical calculated values yields the impurity concentration in the active layer and the carrier density at threshold at $B=0$T. (5 refs.)

71127 Prethreshold optical coupling between parts of a spatially inhomogeneous injection laser. L.A.Rivlin, A.T.Semenov, A.F.Solodkov, V.P.Tabunov, S.D.Yakubovich (All-Union Sci.-Res. Inst. of Optophys. Measurements, Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1499-502 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2310-13 (Nov. 1982). [received: May 1983]
A calculation is made of the rate of optical pumping of a weak-injection region of a two-component semiconductor laser by the radiation emitted from a strong-injection region operating in the subthreshold regime. An experimental determination is reported of the relationship between the optical and electrical coupling of the two regions. A comparison is made of the threshold characteristics of inhomogeneously excited homojunction and heterojunction lasers. (8 refs.)

71128 Restoration of single-frequency emission by suppression of pulsations of the intensity of the radiation emitted by an injection laser. V.N.Morozov, A.S.Semenov, A.B.Sergeev, I.A.Skopin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1513-14 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2326-8 (Nov. 1982). [received: May 1983]
Pulsations of the radiation intensity were suppressed in an injection laser with a transverse *p-n* junction by establishing a feedback via a section of a fiber waveguide brought into contact with the laser. This resulted in emission of just one longitudinal mode from the laser diode. (10 refs.)

The fundamental experiments on optical information processing [with laser diode] .... See Entry 71080

Measurement of the modal reflectivity of an antireflection coating on a superluminescent diode .... See Entry 71135

Generation of picosecond pulses in an injection laser with an external selective resonator .... See Entry 71137

42.55R Lasing action in other solids
(inc. solid Raman lasers)

71129 Influences of thermal effects on high power CW outputs of *b*-axis Nd:YAP lasers. Shen Hong-yuan, Zhou Yu-ping, Yu Gui-fang, Huang Xiao-liang, Wu Cai-ming, Ni Yu-yun (Fujian Inst. of Res. on the Structure of Matter, Acad. Sinica, Fuzhou, China).
Chin. Phys. (USA), vol.3, no.1, p.45-53 (Jan.-March 1983). [received: May 1983]
Based on their previous work, the authors propose here a design of an optical resonator with an elliptical profile of refractive index. Moreover, the influences of thermal effects on the transversal field distribution, the direction of polarization, as well as the output power of *b*-axis Nd:YAP (Nd+Cr:YAP) CW lasers are analyzed. With these factors taken into account, they have been able to achieve 163-W and 152-W laser outputs with nearly linearly polarized beams from a 5.8 mm dia.×111 mm long Nd:YAP rod and a 6.4 mm dia.×100 mm long Nd+Cr:YAP rod and overall efficiencies of 2.26% and 2.11%, respectively. The depolarization and output stability of the laser beam are 1:2900 and less than 2% respectively at a 129.5-W laser output. (11 refs.)

71130 Pulsed gain and thermal lensing of Nd:LiYF$_4$. J.E.Murray (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.488-91 (April 1983).
Measurements show that a 1 cm diameter Nd:YLF rod amplifier produces extremely weak thermal lensing when pulse pumped at 3 Hz to a gain of 13 at 1053 nm. Direct comparison with Nd:YAG indicates much weaker thermal lensing effects for both ordinary and extraordinary polarizations in Nd:YLF. (12 refs.)

71131 Influence of the internal stresses in the YAG:Nd active material on the power of a pulsed laser. J.Kubelka, J.Zikmund.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.3, p.77-8 (March 1983). In Czech.
Theoretical and experimental investigations of the influence of birefringence in the YAG:Nd crystal due to internal stresses on the output power of the laser beam are described. The results indicate that crystals with a certain degree of internal stresses are acceptable for lasers operating in active modulation regime. The method described can be used for the assessment of the permissible birefringence of YAG:Nd. (2 refs.) *E.D.*

A novel numerical model for passively mode-locked solid-state lasers .... See Entry 71100

The self-injected nonmode-locked picosecond laser .... See Entry 71141

Improving the pulse shape in dye laser amplifiers: a new technique .... See Entry 71145

Unpolarized EO *Q*-switched laser .... See Entry 71147

Spectral development of Picosecond pulses of mode-locked Nd-glass lasers .... See Entry 71155

Characterization of pulsed Nd:YAG active/passive mode-locked laser .... See Entry 71156

Single-frequency monopulse neodymium phosphate glass laser with active Q-modulation .... See Entry 71157

42.55T Free electron lasers

71132 Nonlinear self-consistent theory of the orotron. R.P.Leavitt, D.E.Wortman (US Army Electronics Res. & Dev. Command, Harry Diamond Labs., Adelphi, MD, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2219-22 (May 1983).
The authors describe a simple, nonlinear, self-consistent theory of the orotron (a Smith-Purcell free-electron laser) in which the relationship between output power, beam current, and beam accelerating voltage is obtained in closed form. This model explains certain features of the orotoron observed experimentally that were previously poorly understood. Quantitative predictions of the theory are in good agreement with experiment. (13 refs.)

71133 A model for superradiance and superfluorescence in free-electron lasers. R.Bonifacio, F.Casagrande (Dipartimento di Fisica, Univ. di Milano, Milano, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.39-47 (14 May 1983).
The authors consider dissipative effects in the free-electron laser (FEL). They define the concepts of superradiance and superfluorescence for the FEL and state the conditions under which a co-operative (superradiant or superfluorescent) emission of radiation should be expected. First, they present the basic equations of motion for the electron dynamics following a simple, heuristic approach. Next, a set of numerical results are discussed. Finally, they formulate a suitable master equation which allows for a treatment of co-operative effects in FEL dynamics starting at the quantum-statistical level and leads under suitable conditions to the equations of motion previously considered. (15 refs.)

42.60 LASER SYSTEMS AND LASER BEAM APPLICATIONS

71134 Operation of krypton-filled flashlamps at high repetition rates. J.Richards, D.Rees, K.Fueloep, B.A.See (Electronics Res. Lab., Dept. of Defence Support, Adelaide, Australia).
Appl. Opt. (USA), vol.22, no.9, p.1325-8 (1 May 1983).
A technique for operating krypton-filled flashlamps at high repetition rates and with high efficiency in *Q*-switched lasers is described. The technique uses high simmer currents to remove the timing and amplitude jitter that occurs at high repetition rates when krypton-filled lamps are run with conventional, low simmer currents. Besides giving excellent pulse-to-pulse reproducibility in the laser output, the method also removes any tendency for the lamp to misfire or extinguish. (7 refs.)

71135 Measurement of the modal reflectivity of an antireflection coating on a superluminescent diode. I.P.Kaminow, G.Eisenstein, L.W.Stulz (Crawford Hill Lab., Bell Labs., Holmdel, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.493-5 (April 1983).
A method for measuring the modal reflectivity of the antireflection coating applied to a laser diode is described and demonstrated. It is based on measurements of the Fabry-Perot modulation depth of the resulting superluminescent diode (SLD) output spectrum at the threshold current of the original laser. A modal reflectivity of less than 2×10^{-4} has been obtained. (8 refs.)

71136 Synchronous amplification of subpicosecond pulses. T.Sizer,II, J.D.Kafka, I.N.Duling,III, C.W.Gabel, G.A.Mourou (Lab. for Laser Energetics & Inst. of Optics, Univ. of Rochester, Rochester, NY, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.506-11 (April 1983).
In high-gain dye amplifiers, the effective storage time of the gain medium is only a few hundred picoseconds. Therefore, efficient amplification of ultrashort pulses places a stringent requirement on the synchronization between the pump pulse and the pulse to be amplified. The authors present a technique of short pulse generation using a dye laser synchronously pumped by a frequency-doubled CW mode locked Nd:YAG laser. Pulses as short as 70 fs are produced. The short optical pulses are subsequently amplified with two different synchronous amplification schemes using 100 ps pulses to establish the gain in the dye amplifier stages. Subpicosecond pulses with energies from a few hundred nanojoules at 500 Hz to a few hundred microjoules at 7 Hz can be obtained. (16 refs.)

71137 Generation of picosecond pulses in an injection laser with an external selective resonator. Yu.L.Bessonov, A.P.Bogatov, P.P.Vasil'ev, V.N.Morozov, A.B.Sergeev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1510-12 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2323-6 (Nov. 1982). [received: May 1983]
Pulses of 15 psec duration were generated by an injection laser with an external dispersive resonator operating in the active mode-locking regime. This regime was attained by subjecting the laser diode to a current of high frequency equal to the intermode interval in the external resonator. The duration of the pulses was determined by an autocorrelation method in which the second harmonic was generated in an LiIO$_3$ crystal. (10 refs.)

Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter .... See Entry 69774

Masers and lasers. An historical approach .... See Entry 69805

Laser processing and analysis of materials .... See Entry 69807

42.60B Design of specific laser systems

71138 Radio-frequency-excited carbon dioxide metal waveguide laser. J.G.Grossman, L.W.Casperson, O.M.Stafsudd (School of Engng. & Appl. Sci., Univ. of California, Los Angeles, CA, USA).
Appl. Opt. (USA), vol.22, no.9, p.1298-305 (1 May 1983).
A new type of waveguide laser is described in which a single-surface concave metal waveguide also doubles as the grounded electrode in a radio-frequency-excited gaseous discharge. The laser's output modes and spectrum have been studied theoretically and experimentally for CW CO_2 operation of the laser. Overall operating efficiency and mode stability are comparable with those of conventional dielectric waveguide CO_2 lasers, and advantages of the metal waveguide laser include convection cooling, intracavity mode control, and partial self-alignment. (32 refs.)

71139 The HeNe Laser: How to buy one. IV. B.Patel (Siemens Components Inc., Iselin, NJ, USA).
Photonics Spectra (USA), vol.17, no.4, p.39-43 (April 1983).
For pt.III see ibid., vol.17, no.3, p.34-8 (1983). The author concludes with some guidelines on HeNe laser selection and purchasing. Parameters generally found in most HeNe laser specifications are listed into the three categories—optical, electrical and physical. (no refs.)

71140 The HeNe laser: putting it all together. III. B.Patel (Siemens Components Inc., Iselin, NJ, USA).
Photonics Spectra (USA), vol.17, no.3, p.34-8 (March 1983).
For pt.II see ibid., vol.17, no.2, p.33-4 (1983). Covers the integration of laser tubes, power supplies, external optics and support components, and the testing of the complete system. Specifications are given for safe and accurate mounting of a HeNe laser tube. To obtain both the maximum stable output from a HeNe laser and its typically long life, it is imperative that a laser system designer have a good understanding of pertinent laser electrical characteristics. To compensate for negative resistance effects, a ballast resistor is required. Modulation of the continuous-wave (CW) output of a HeNe laser can be accomplished by acousto-optic modulators or 'Bragg cells'. Five key parameters must be tested to insure that a laser performs in accordance with its published specifications. These are: output power, beam diameter, beam position, operating voltage and break current. (no refs.)

71141 The self-injected nonmode-locked picosecond laser. C.H.Brito Cruz, F.De Martini, P.Mataloni (Quantum Optics Lab., Istituto di Fisica 'G. Marconi', Univ. di Roma, Rome, Italy).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.573-7 (April 1983).
A new type of laser which generates picosecond pulses is presented. 6 ps. ~1 GW, 3 pps, $\lambda=1.06$ μm in a single pulse are obtained with good stability. Accurate timing of the pulses can be achieved, and no external pulse selection is required. In this laser, the pulse does not develop from quantum noise, but is the result of a nonlinear frequency and time processing in the cavity of a seed pulse that is coherent from the beginning of the shortening process. The authors believe that the remarkable characteristics of pulse stability are at least partially due to these considerations in coherence. (21 refs.)

71142 High-power continuously tunable atmospheric-pressure CO_2 laser operating in the superregenerative amplification regime. A.Z.Grasyuk, S.V.Efimovskii, A.K.Zhigalkin, S.I.Fomin (P.N. Lebedev Phys. Inst., Acad. of Sci., Troitsk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1531-3 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2348-50 (Nov. 1982). [received: May 1983]
The phenomenon of regenerative amplification was used as the basis of a high-power (~50 MW) continuously tunable atmospheric-pressure CO_2 laser with ultraviolet preionization. Lasing was observed in an optical system in which a high-pressure CO_2 laser was used as a master oscillator. When an energy of the order of 500 μJ was injected into a nonselective confocal unstable resonator of a regenerative amplifier, the continuous tuning range reached $\sim(4\text{-}5)\times10^{-2}$ cm^{-1} for each of the several lines in the *P* and *R* branches and the width of the emitted line was $\delta\nu_{las}\lesssim(4\text{-}5)\times10^{-3}$ cm^{-1}. (14 refs.)

Oscillatory continuum emission from Br_2 following vacuum ultraviolet laser excitation .... See Entry 70934

Improved lasing performance of KrCl excimer laser .... See Entry 71108

Photochemical xenon-oxide laser .... See Entry 71114

1.5-1.6-μm $Ga_{0.47}In_{0.53}As/Al_{0.48}In_{0.52}As$ multiquantum well lasers grown by molecular beam epitaxy .... See Entry 71118

Short cavity InGaAsP/InP lasers with dielectric mirrors .... See Entry 71119

New large optical cavity laser with distributed active layers ... See Entry 71120

A high-power, single-mode laser with twin-ridge-substrate structure .... See Entry 71121

Bistability and slow oscillation in an external cavity semiconductor laser .... See Entry 71122

Influences of thermal effects on high power CW outputs of *b*-axis Nd:YAP lasers .... See Entry 71129

Improving the pulse shape in dye laser amplifiers: a new technique .... See Entry 71145

Pulse compression by pulse-stacking in a KrF amplifiers .... See Entry 71146

Unpolarized EO *Q*-switched laser .... See Entry 71147

Single-frequency monopulse neodymium phosphate glass laser with active Q-modulation .... See Entry 71157

Optically pumped FIR lasers phase-locked by Stark effect applied to precise optical frequency measurements .... See Entry 71162

42.60D Laser resonators and cavities

71143 Properties of *Q* switches with partial polarizers. K.L.Vodop'yanov, L.A.Kulevskii, A.A.Malyutin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1480-5 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2280-8 (Nov. 1982). [received: May 1983]
An analysis is made of the polarization eigenstates of laser resonators containing electrooptic and magnetooptic *Q* switches with partial polarizers. The characteristic features of the behavior of polarization states and their eigenvalues are determined. A resonator with an active element which does not cause depolarization of the radiation is considered and it is found that the *Q*-switching curve has a region with an infinite derivative with respect to the control field. The results of calculations are checked experimentally. (7 refs.)

Branch-selected infrared laser ring cavity for ultrahigh resolution spectroscopy .... See Entry 70126

On the critical length of a laser .... See Entry 71103

Thermal homogeneity in a closed excimer laser cavity .... See Entry 71109

Gain anisotropy in low-pressure chemical lasers .... See Entry 71112

Short cavity InGaAsP/InP lasers with dielectric mirrors .... See Entry 71119

New large optical cavity laser with distributed active layers ... See Entry 71120

Bistability and slow oscillation in an external cavity semiconductor laser .... See Entry 71122

Influences of thermal effects on high power CW outputs of *b*-axis Nd:YAP lasers .... See Entry 71129

Generation of picosecond pulses in an injection laser with an external selective resonator .... See Entry 71137

The self-injected nonmode-locked picosecond laser .... See Entry 71141

High-power continuously tunable atmospheric-pressure CO_2 laser operating in the superregenerative amplification regime .... See Entry 71142

Unpolarized EO *Q*-switched laser .... See Entry 71147

Pulse shaping in passively mode-locked ring dye lasers .... See Entry 71150

Calculation of the colliding pulse mode locking in CW dye ring lasers .... See Entry 71151

Single and double mode-locked ring dye lasers—theory and experiment .... See Entry 71153

Characterization of pulsed Nd:YAG active/passive mode-locked laser .... See Entry 71156

Simultaneous determination of the spectral and temporal properties of tunable, single, picosecond pulses from a short cavity dye laser .... See Entry 71163

Pulse shortening in dye laser side-pumped by TEA N_2 laser ... See Entry 71164

Passive mode locking in iodine photodissociation laser .... See Entry 71167

Power characteristics of an He-Ne laser utilizing the $3s_2$-$2p_6$ transition in neon ($\lambda=612$ nm) and containing a $^{127}I_2$ absorption cell .... See Entry 71169

Modes of phase-conjugate resonators with bounded mirrors .... See Entry 71193

Three-dimensional phase-conjugate-resonator performance ...... See Entry 71194

Generalized mode theory of conventional and phase-conjugate resonators .... See Entry 71195

Nonideal phase-conjugate resonators—a canonical operator analysis .... See Entry 71196

Transportation of far-IR bemas for use in plasma diagnostics .... See Entry 71790

42.60F Laser beam modulation

71144 Building a simple reliable low-cost modelocker system. G.F.Albrecht, L.Lund, D.Smith (Lab. for Laser Energetics, Univ. of Rochester, Rochester, NY, USA).
Appl. Opt. (USA), vol.22, no.9, p.1276-80 (1 May 1983).
Since the addition of a modelocker to a passive modelocked laser oscillator results in a great improvement of just about all output characteristics, the authors wish to describe how to build a modelocker system of commercial performance with resources that are within reach of most university laboratories. (27 refs.)

71145 Improving the pulse shape in dye laser amplifiers: a new technique. P.Kumar, R.S.Bondurant (MIT Res. Lab. of Electronics, Cambridge, MA, USA).
Appl. Opt. (USA), vol.22, no.9, p.1284-7 (1 May 1983).
In this paper the authors describe a new technique to improve the performance of Nd:YAG laser-pumped dye laser amplifiers. Such amplifiers exist in many laboratories worldwide and use the commercially available Nd:YAG lasers as pump sources. This techniques uses a few beam splitters and mirrors external to the Nd:YAG laser cavity. No modification to the Nd:YAG laser itself is required. Amplified pulses obtained in this way are transform-limited to within a factor of 2. (15 refs.)

71146 Pulse compression by pulse-stacking in a KrF amplifiers. M.W.Taylor, J.Goldhar (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Appl. Opt. (USA), vol.22, no.9, p.1288-92 (1 May 1983).
A laser pulse-compression technique employed to obtain intense pulses (~1 GW) from an electron-beam-pumped KrF amplifier is demonstrated. This technique consists of time-sequencing and angle-coding separate pulses through the amplifier. The system described uses four pulses for a nominal temporal compression factor of 4. The input vs. output temporal pulse shapes and saturation characteristics are demonstrated. Also discussed are the issues of parasitic oscillations, optical cross talk, saturation pulse broadening, and limitations on scaling to larger compression factors. (12 refs.)

71147 Unpolarized EO *Q*-switched laser. J.Richards (Dept. of Defence Support, Electronics Res. Lab., Adelaide, Australia).
Appl. Opt. (USA), vol.22, no.9, p.1306-8 (1 May 1983).
A novel laser design is given that uses a special polarizing device to generate unpolarized *Q*-switched laser energy with a conventional EO Pockels cell. The special polarizing device, which replaces the linear polarizer normally used in conventional *Q*-switched resonators, allows solid-state lasers to operate efficiently at high repetition rates. Other features of the design include the elimination of the beam nonuniformities that normally occur at high repetition rates, the elimination of the need to bias the Pockels cell, and the ability to produce, by a simple mirror realignment, a plane-polarized output with high efficiency. (7 refs.)

71148 Femtosecond optical pulses. R.L.Fork, C.V.Shank, R.Yen, C.A.Hirlimann (Bell Labs., Holmdel, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.500-6 (April 1983).
Reviews recent advances in generation, amplification, compression, and frequency broadening of femtosecond optical pulses. The authors describe use of colliding pulse mode locking to generate pulses of 65 fs duration and pulse compression to reduce those pulse durations to 30 fs. Amplification of femtosecond pulses to gigawatt powers and frequency broadening to obtain white light continuum pulses while retaining femtosecond pulse durations are also examined. (16 refs.)

71149 Ultrashort pulse propagation in saturable media: a simple physical model. N.J.Frigo (LASSP & Material Sci. Center, Cornell Univ., Ithaca, NY, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.511-19 (April 1983).
Presents a descriptive model of ultrashort pulse propagation in saturable amplifying and absorbing media, emphasizing a pictorial representation of the relevant parameters. The rate equation approximation is used and the earlier

results of Frantz and Nodvik (see J. Appl. Phys., vol.34, p.2346, 1963) are both generalized and placed in a more intuitive form. A formal procedure is developed for analyzing multilevel systems that are more complicated than the basic two- and four-level models. Examples involving dye mixtures, linear, ring, and colliding pulse mode-locked lasers are presented, illustrating the ease with which the model can be applied. (17 refs.)

71150 Pulse shaping in passively mode-locked ring dye lasers. M.S.Stix (Dept. of Phys. & Res. Lab. of Electronics, MIT, Cambridge, MA, USA), E.P.Ippen.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.520-5 (April 1983).
The concept of 'pulse shortening velocity' is introduced as a simplified measure of pulse width performance in passively mode-locked ring dye lasers. Pulse shapes have been computed for a variety of operating conditions. The influence of coherent coupling in colliding pulse systems is found to be essentially equivalent to that of an increased saturable absorber cross section. (12 refs.)

71151 Calculation of the colliding pulse mode locking in CW dye ring lasers. D.Kuhlke, W.Rudolph, B.Wilhelmi (Dept. of Phys., Friedrich Schiller Univ., Jena, Germany).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.526-33 (April 1983).
A calculation of the influence of a transient absorber grating on the pulse parameters of a dye laser in the 'colliding pulse mode-locking' (CPM) regime is given. It is shown that, compared to other passive methods, considerably shorter pulses with a more favorable stability region can be obtained. Within the stability range of single pulse operation the shortest pulses in the CPM are obtained by operating far above threshold where the saturation energy of the amplifier is much greater than that of the absorber. Deviation from an amplifier position that is symmetric with respect to the amplification of the counter-running pulses leads to different energies of the pulses and to a strong decrease of the stability range. Taking the dispersive properties of absorber and amplifier into consideration, equations for the time dependent phase of the laser pulse are established and solved by an analytical ansatz. The resulting pulse chirp is shown to be mainly dependent on the detuning of the pulse frequency from the center frequency of the saturable absorber. The estimated values for the pulse duration and the down-chirp for typical experimental conditions of a rhodamine 6G-DODCI CPM laser agree well with the measured ones. (10 refs.)

71152 Compression mechanism of subpicosecond pulses by malachite green dye in passively mode-locked rhodamine 6G/DODCI CW dye lasers. A.Watanabe (Dept. of Electronics, Faculty of Engng., Tottori Univ., Tottori, Japan), H.Takemura, S.Tanaka, H.Kobayashiu, M.Hara.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.533-9 (April 1983).
The pulse width compression effect of a malachite green (MG) dye upon subpicosecond pulses has been experimentally investigated in a CW passively mode-locked rhodamine 6G/DODCI dye laser. The pulse width reduces as MG concentration increases, and reaches 0.34 ps at 1.5×10^{-6} M. By adding the MG dye, good mode locking is achieved in a rather wide pumping-power range. A computer simulation of pulse growth has also been carried out by using simple rate equations, in which the fast-recovery component of loss due to the MG dye is taken into account. The simulated results can explain some experimental results qualitatively such as pulse width compression results essentially from the fast recovery of cavity loss caused by the MG dye. (18 refs.)

71153 Single and double mode-locked ring dye lasers—theory and experiment. K.K.Li (Dept. of Electrical Engng. & Computer Sci., Univ. of California, Berkeley, CA, USA), G.Arjavalingam, A.Dienes, J.R.Whinnery.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.539-44 (April 1983).
A computer model is made of the colliding-pulse ring dye laser for mode-locked production of short pulses. Initial conditions of either noise or a small CW oscillation eventually result in the same final solution. Resolution is 10 ps in the model, and a digital filter represents dispersion. A gain-sharing long pulse mode often results, but large effective absorption cross section in the mode-locking dye and optimum separation of the two dyes (one quarter of the total resonator length) favor the desired short pulse formation. The model does not include the transient grating effect. Experiments with a ring laser using rhodamine 6G and DODCI confirmed the parameters important to the two regions. Double mode locking, in which the mode-locking dye also lases, was also studied both in the model and experimentally. It is not yet clear if the advantages of colliding pulse mode locking apply to double mode locking. (12 refs.)

71154 Passive mode locking of flashlamp-pumped dye lasers in the 508-583 nm range. W.Sibbett, J.R.Taylor (Optics Section, Blackett Lab., Imperial Coll., London, England).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.558-61 (April 1983).
Measurements of the pertinent characteristics of a new saturable absorber dye (DASBTI) are presented, together with results which demonstrate its usefulness in the passive mode locking of several flash-lamp-pumped dye lasers operating within the 508-583 nm wavelength region. (17 refs.)

71155 Spectral development of Picosecond pulses of mode-locked Nd-glass lasers. A.Penzkofer, N.Weinhardt (Naturwissenschaftliche Fakultat II-Phys., Univ. Regensburg, Regensburg, Germany).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.567-73 (April 1983).
The spectra of single picosecond pulses of mode-locked Nd-glass lasers are investigated along the pulse train. In addition to self-phase modulation, the spectra are modified due to spectral hole burning in the inhomogeneous gain profile of the active medium. (48 refs.)

71156 Characterization of pulsed Nd:YAG active/passive mode-locked laser. H.P.Kortz (Quantel Internat. Inc., Santa Clara, CA, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.578-84 (April 1983).
The influence of the distance of an active modulator to one of the resonator's end mirrors is investigated both theoretically and experimentally and is found not to be critical for high-gain lasers. The effect of the active modulator on the pulse length of an active/passive mode-locked Nd:YAG laser is discussed qualitatively. Threshold, stability, pulse length, and output energy are investigated experimentally with respect to their dependence on modulation power of the active modulator, dye concentration of the passive modulator and resonator length mismatch. At a repetition rate of 10 Hz the best achievable stability for the pulse-train energy was ±1 percent with a single pulse length of 25 ps. The resonator length has to be maintained with an accuracy of ±100 μm. (13 refs.)

71157 Single-frequency monopulse neodymium phosphate glass laser with active Q-modulation. V.M.Leont'ev, S.F.Sitnikov, V.I.Sokolov (Inst. of Atomic Energy, Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1000-4 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.199-202 (July-Aug. 1982). [received: May 1983]
Describes a single-frequency monopulse neodymium phosphate glass master oscillator whose operation is based on the principle of self-capture of radiation of a single-frequency free generation beam. The radiation energy is 20 mJ, the radiation spectrum width is 0.8×10^{-3} cm^{-1}, the pulse duration at the half-level is 40 nsec, and the instability of the generation wavelength is <1 Å. The probability of reproducibility of the single-frequency radiation is ≥0.98, and the divergence of the radiation is 1.2×10^{-3}. It is possible to obtain a series of identical single-frequency pulses near 1 pumping pulse. The generator is connected to a laser system having a single-frequency radiation output energy of ~120 J. (16 refs.)

A novel numerical model for passively mode-locked solid-state lasers .... See Entry 71100

Measurement of the modal reflectivity of an antireflection coating on a superluminescent diode .... See Entry 71135

Properties of *Q* switches with partial polarizers .... See Entry 71143

42.60H Optical problems related to properties and interactions of laser beams

71158 Measuring focused Gaussian beam spot sizes: a practical method. Y.C.Kiang, R.W.Lang (Internat. Business Machines Corp., Poughkeepsie, NY, USA).
Appl. Opt. (USA), vol.22, no.9, p.1296-7 (1 May 1983).
The rapidly growing use of the laser in experimental work has created a need for accurately recording the laser power density for comparison and duplication purposes. This paper presents a straightforward procedure for measuring the focused Gaussian beam diameter. (6 refs.)

71159 An optical discharge in a condensed medium. N.E.Kask, L.S.Kornienko (Nuclear Phys. Res. Inst., Lomonosov Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.1-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1010-17 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
The stationary state of propagation of an optical discharge within the bulk of a condensed medium has been realized with a laser beam acting on optical glass. New information has been obtained on the largely unexamined stage of optical breakdown in glass: from the instant of initiation of thermal instability to the occurrence of damaging stresses. Measurements have been made on the parameters of the dense nonideal breakdown plasma, and studies have been made on the scope for using an optical discharge as a method of examining the state of the material with a specific volume several times greater than the specific volume of the condensed medium. (10 refs.)

71160 Thermophysical processes in the interaction of laser radiation with absorbing media. N.N.Rykalin, A.A.Uglov (Baikov Inst. of Metall., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.8-14 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1018-25 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
Calculations are presented on nonstationary nonlinear three-dimensional heating of metals by a laser beam, and also the nonstationary ablation of a plate produced by surface heat sources. The oscillations occurring when a laser beam acts on a material are examined and experimental data are presented on effects in gases at elevated pressures. Results are presented on the thermal and gas-dynamic processes in a high-pressure laser plasma. Experimental data are given on the synthesis of various materials and on the reduction of refractory metals in a laser plasma. (28 refs.)

71161 Statistical trends in laser damage. Yu.K.Danilenko (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.95-101 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1119-26 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
The various effects in laser damage due to defects in the optical material are considered from a unified viewpoint, which covers the size dependence of the damage threshold, the statistics of the laser strength fluctuations, and the actual geometry of the focusing. Various methods are discussed for examining the set of microdefects responsible for damage. Some experiments demonstrate the effects of these in laser damage. (14 refs.)

71162 Optically pumped FIR lasers phase-locked by Stark effect applied to precise optical frequency measurements. B.Dahmani, A.Clairon (Lab. Primaire du Temps et des Frequences, Paris, France).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.150-4 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
A far infrared (FIR) optically pumped laser including an hybrid waveguide for Stark effect has been constructed. Frequency variations of the 4.5 THz (70 μm) line of CH_3OH versus applied electric voltage has been observed and explained using gain anisotropy. This laser has been phase-locked on a saturated fluorescence-stabilized $^{13}CO_2$ laser at 29.77 THz to allow the realization of new precise optical frequency measurements. (21 refs.)

71163 Simultaneous determination of the spectral and temporal properties of tunable, single, picosecond pulses from a short cavity dye laser. G.W.Scott (Dept. of Chem., Univ. of California, Riverside, CA, USA), J.H.Clark, M.A.Tolbert, S.P.Webb, A.J.Cox, G.Renz.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.544-50 (April 1983).
The authors report simultaneous quantitative spectral and temporal measurements of the output pulses from a single-axial mode rhodamine 6G short cavity (1-8 μm) dye laser. The dye laser was pumped at 10 Hz with single second harmonic (532 nm) pulses from a mode-locked Nd^{+3}:YAG laser. Spectral measurements made with a high resolution spectrograph and temporal measurements made with an ultrafast streak camera indicate the production of Fourier transform limited pulses for near threshold operation. Output pulses of 7-14 ps (FWHM) are observed from the short cavity dye laser when pumped with 15-30 ps duration 532 nm pulses. The output pulse delay and jitter are also investigated. A theoretical model for the temporal evolution of the pulses is presented and compared with the experimental results. (16 refs.)

71164 Pulse shortening in dye laser side-pumped by TEA N_2 laser. H.Uchiki, M.Yoshizawa, T.Kobayashi (Dept. of Phys., Faculty of Sci., Univ. of Tokyo, Tokyo, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.551-7 (April 1983).
The temporal behavior of the output from a homemade TEA-N_2-laser (750 ps pulsewidth) pumped dye (R6G) laser was observed with the aid of a streak camera. The observed output pulsewidths are between 60 and 160 ps depending on the configuration of the dye laser cavity. The shortest (60 ps) pulse is

obtained when the distances between output mirror and dye cell, and dye cell and grating, are 10 and 105 mm, respectively. The mechanism of the short pulse generation is clarified by comparing experimental results with the results obtained by solving rate equations numerically, where the position dependences of excited-state population and photon flux were taken into account. (18 refs.)

71165 Voltage pulse generation using CO_2 laser irradiated solid target plasmas. G.Cook, P.E.Dyer (Dept. of Appl. Phys., Univ. of Hull, Hull, England).
J. Phys. D (GB), vol.16, no.5, p.889-96 (14 May 1983).
Voltage pulses generated as a result of electron emission from a CO_2 laser-produced solid target plasma have been studied and analysed with the aim of evaluating the suitability of the plasma cell as a pulse-shape detector. The optimum output voltage is found to be relatively insensitive to target chamber geometry and maximises with a background gas pressure of $\sim 10^{-2}$ kPa, independent of gas species or target material. Voltage-current characteristics for a Cu plasma suggest that the plasma cell behaves as a thermionic generator and a model has been developed which gives a reasonable account of the experimental results. Whilst high voltages (>100 V into 50 Ω) can be produced using a modest TEA CO_2 laser, the nonlinearity of response limits the usefulness of the plasma cell as a pulse-shape detector. (12 refs.)

71166 Heterodyne analysis of laser modes. K.M.Abramski, E.F.Plinski (Inst. of Telecommunication & Acoustic, Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.329-40 (1982).
Describes a method using beating laser beams for the analysis of a spectral mode laser exhibiting a high resolving power. The analysis parameters, i.e., spectral resolving power and tuning rate were optimized. Experimental examples of the procedure of heterodyne analysis of He-Ne 3.39 μm and CO_2 lasers are also presented. (4 refs.)

71167 Passive mode locking in iodine photodissociation laser. I.M.Belousova, A.S.Grenishin, V.M.Kiselev, M.A.Kudinova, Yu.L.Slominskii, A.I.Tolmachev (Inst. of Organic Chem., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1502-4 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2313-16 (Nov. 1982). [received: May 1983]
An investigation was made of a group of dyes suitable for the use in passive mode locking in a laser resonator with an operating wavelength in the range 1.1-1.4 μ. An iodine dissociation laser was used by way of illustration to demonstrate experimentally the generation of pulses of 0.3 nsec duration. (11 refs.)

71168 Changes in the polarization structure of laser radiation by lens systems. P.I.Lamekin, K.G.Predko (Inst. of Phys., Acad. of Sci., Mogilev, Belorussian SSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1516-18 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2330-3 (Nov. 1982). [received: May 1983]
An investigation is made of changes in the inclination of the plane of oscillation and of the degree of linearity of the polarization in the course of propagation of laser radiation through lens systems. It is shown that after passage through an analyzer the intensity distribution in a beam that has crossed such a lens system becomes inhomogeneous. (5 refs.)

71169 Power characteristics of an He-Ne laser utilizing the $3s_2$-$2p_6$ transition in neon ($\lambda=612$ nm) and containing a $^{127}I_2$ absorption cell. M.V.Danileiko, A.M.Tselinko, L.P.Yatsenko (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1529-30 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2346-7 (Nov. 1982). [received: May 1983]
An experimental investigation was made of the power characteristics of an He-Ne/I_2 laser utilizing the $3s_2$-$2p_6$ transition in neon ($\lambda=612$ nm). The parameters of the active medium corresponding to the maximum output power were determined and high-contrast resonances of saturated absorption were recorded. (9 refs.)

Laser beam deflection by thermal gradient .... See Entry 69844

Laser frequency measurements and the redefinition of the meter .... See Entry 70029

Spectrograph for investigating spectra of pulsed infrared lasers .... See Entry 70128

Reflective optics system for multiple beam laser fusion .... See Entry 71171

Generation of tunable picosecond pulses in the ultraviolet and blue-green parts of the spectrum with the aid of a distributed-feedback dye laser .... See Entry 71187

Self-focusing of Gaussian beams: an alternate derivation .... See Entry 71207

Examination of ultrarapid relaxation in a medium by space-time modulation of the perturbing light .... See Entry 71208

Transportation of far-IR bemas for use in plasma diagnostics .... See Entry 71790

42.60K Optical problems related to applications of laser beams

71170 Electronic control of the difference frequency between two semiconductor lasers. R.Steele (Dept. of Electronic & Electrical Engng., Univ. of Glasgow, Glasgow, Scotland), S.Wright.
Ann. Telecommun. (France), vol.38, no.1-2, p.53-7 (Jan.-Feb. 1983).
A method for controlling the difference frequency between two semiconductor lasers has been developed. The beat frequency is directly measured and current feedback applied to one laser to control this frequency. Stability to plus or minus 10 MHz was achieved. Applications include coherent optical communication systems. (6 refs.)

71171 Reflective optics system for multiple beam laser fusion. D.G.Burkhard, G.L.Strobel (Dept. of Phys. & Astron., Univ. of Georgia, Athens, GA, USA).
Appl. Opt. (USA), vol.22, no.9, p.1313-17 (1 May 1983).
A reflective optics system is described that will uniformly heat or transfer momentum to a spherical target. Six laser beams of three split beams are incident along three mutually perpendicular axes. The beams are reflected from cones with a 45° half-angle onto an aspheric reflector wings shaped to impart uniform heat or momentum to the target. A sample calculation shows that, for a target sphere with 1.5 index of refraction, 93% of the energy incident on the target is transmitted into the target. For smaller indices, a greater fraction of the incident energy is imparted to the target. The design provides completely uniform transmitted light as well as nearly orthogonal distribution of light over the target and is relatively insensitive to alignment errors. (5 refs.)

Laser interferometer gravitational radiation detectors .... See Entry 69971

Laser frequency measurements and the redefinition of the meter .... See Entry 70029

The eikonal approximation applied to sizing transparent fibres using the scattered intensity-ratio technique .... See Entry 70030

A new kind of gyro that isn't really a gyro at all .... See Entry 70056

Branch-selected infrared laser ring cavity for ultrahigh resolution spectroscopy .... See Entry 70126

Helium streamer chamber with laser track registration at gas pressures of up to 5 atm .... See Entry 70751

The fundamental experiments on optical information processing [with laser diode] .... See Entry 71080

Transportation of far-IR bemas for use in plasma diagnostics .... See Entry 71790

Analysis of conditions for powder surface deposition by laser .... See Entry 73236

High spectral resolution lidar system with atomic blocking filters for measuring atmospheric parameters .... See Entry 73924

Random modulation CW lidar .... See Entry 73925

Resonant extinction of lidar returns from the alkali metal layers in the upper atmosphere .... See Entry 73953

42.65 NONLINEAR OPTICS

71172 Spectral dependence of reversible optically induced transitions in organometallic compounds. R.C.Benson, R.C.Hoffman, R.S.Potember, E.Bourkoff, T.O.Pehler (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.855-7 (15 May 1983).
Optical switching in the class of semiconducting organometallic films such as copper and silver tetracyanoquinodimethane (CuTCNQ and AgTCNQ) can be erased using CO_2 laser radiation. Results on the wavelength and irradiance dependence of the optical switching threshold are also presented and interpreted in light of proposed switching mechanisms in these organic materials. (11 refs.)

71173 An analysis on characteristic of the hybrid optical bistability. Li Yung-gui, Zhang Hong-jun (Inst. of Phys., Acad. Sinica, Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.301-8 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The characteristic of optical bistability is analysed theoretically for the photoelectric modulator with a feedback circuit. The effect of the 'critical slowing down' for a step input as it operates in the bistable mode is discussed. (11 refs.)

71174 Polarization instability in a light wave in a highly nonlinear medium. S.A.Akhmanov, N.I.Zheludev, Yu.P.Svirko (Moscow State Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.53-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1070-4 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
New nonlinear optical properties in a medium are discussed for conditions where the nonlinear correction to the electrical induction is not small by comparison with the linear part. It is shown theoretically that one can then get polarization hysteresis, which constitutes a generalization to strong fields of the effects of nonlinear rotation of the polarization ellipse and nonlinear optical activity. (7 refs.)

71175 Reduction of angular momentum coupling trees and the polarization dependence of nonlinear optical processes. R.A.Minard, G.E.Stedman, A.G.McLellan (Dept. of Phys., Univ. of Canterbury, Christchurch, New Zealand).
J. Chem. Phys. (USA), vol.78, no.8, p.5016-23 (15 April 1983).
Diagrams representing angular momentum coupling trees with vector ($j=1$) external labels in a Cartesian basis and with even degree (up to 8) are expressed as sums of products of Kronecker delta functions. Integrity basis theory is used to verify the possibility of such a representation, and to determine the number of independent invariants. The results are of use in the analysis of irreducible Cartesian tensors and thus, e.g. in nonlinear optics. As examples, the polarization dependences of the hyper-Raman and three-photon Raman effects are discussed. (24 refs.)

71176 Novel class of nonlinear surface waves: asymmetric modes in a symmetric layered structure. N.N.Akhmediev.
Sov. Phys.-JETP (USA), vol.56, no.2, p.299-303 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.545-53 (Aug. 1982). [received: May 1983]
Wave propagation is considered in a symmetric layered structure consisting of a layer having a linear dielectric constant between two layers of a medium whose dielectric constant depends quadratically on the amplitude of the wave electric field. It is shown that besides symmetric and antisymmetric modes there can exist in the structure asymmetric modes at energy fluxes exceeding a certain minimum value. Plots of the energy flux vs. the propagation constant are obtained for each of the modes considered. It is shown that asymmetric-modes branch out in these plots from the symmetric and antisymmetric modes upon increase of the energy flux in the wave. The plots themselves are *N*-shaped in a certain range of layer thicknesses; this may lead to bistable states of the surface waves if the energy flux in the wave is the external parameter. (5 refs.)

71177 Optical transistors and bistable devices utilizing nonlinear transmission of light in systems with unidirectional coupled waves. A.A.Maier (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1490-4 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2296-302 (Nov. 1982). [received: May 1983]
An analysis is made of nonlinear transmission (self-switching, self-modulation) of light in tunnel-coupled cubically nonlinear waveguides and other optical systems carrying unidirectional waves with a distributed coupling which become separated at the exist from a system if at least one of the waves travels in a medium with a cubic (Kerr) susceptibility. Optical transistors and bistable devices based on these systems are considered. The threshold energy of bistable devices based on coupled GaAs waveguides is $\sim 10^{-10}-10^{-9}$ J. (12 refs.)

Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter .... See Entry 69774

42.65B General theory

71178 Hamiltonian and recursion operator for the reduced Maxwell-Bloch equations. R.N.Aiyer (Laser Section, Bhabha Atomic Res. Centre, Bombay, India).
J. Phys. A (GB), vol.16, no.8, p.1809-11 (1 June 1983).
The Hamiltonian of the reduced Maxwell-Bloch equations (RMBE), an integrable nonlinear evolution equation, is derived. The recursion operator, its inverse and also the hierarchy of higher-order RMBE are obtained. (4 refs.)

42.65C Stimulated Raman, Brillouin and Rayleigh scattering; parametric oscillations and harmonic generation

71179 On the nature of the frequency-angular structure of stimulated Raman scattering in liquids. M.E.Kornienko, V.I.Malii, G.V.Ponezha, O.O.Ponezha.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.64-6 (1983). In Ukrainian.
Anti-Stokes Raman polariton scattering of light in liquids induced by stimulated Raman scattering is found. This phenomenon explains anomalies in spectral and angular characteristics of stimulated Raman scattering and permits studying relaxation of oscillation excitations. Results of a theoretical calculation agree with the experimental data. (3 refs.)

71180 Threshold technique for measuring parametric upconversion efficiency. F.L.Schow (Sandia Labs., Albuquerque, NM, USA), A.Riazi, O.P.Gandhi, R.W.Grow.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.491-2 (April 1983).
An experimental procedure which involves measurement of threshold values of infrared and upconverted powers for evaluating the quantum efficiency of a parametric upconverter is described. The threshold method is employed to determine the efficiency of a dye laser proustite upconversion system. (5 refs.)

71181 Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide. R.H.Lehmberg (Naval Res Lab., Washington, DC, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.558-66 (May 1983).
Phase conjugation in stimulated Brillouin scattering (SBS) from an optical waveguide is studied numerically, using a Cartesian two-dimensional propagation code (BOUNCE) that includes pump depletion. The simulations show that light scattered back through a phase aberrator produces a far-field profile closely matching that of the incident beam; however, the near-field intensity exhibits large and rapid spatial inhomogeneities across the entire aberrator, even for conjugation fidelities H as high as 98%. This effect can be only partially removed by spatial-filtering techniques. The dependence of H on SBS gain, scattering length L, and the average intensity $\bar{I}$ and angular divergence θ_D of the pump beam is first studied in the low-reflectivity regime (i.e. ignoring pump depletion). For amplitude gains $\gtrsim e^{10}$, H decreases monotonically with the factor $\bar{I}/\theta_D$ that is due to a small-scale intensity pulling effect. This result appears to be independent of whether θ_D arises entirely from the aberrator or from a combination of the aberrator plus curvature introduced by a lens. In all cases, pump depletion is found to enhance the fidelity by inhibiting the small-scale pulling effect. Under appropriate conditions, this can actually reverse the intensity dependence of H seen in the absence of pump depletion. (26 refs.)

71182 Enhanced four-wave mixing from silver particles. D.S.Chemla, J.P.Heritage, P.F.Liao, E.D.Isaacs (Bell Labs., Holmdel, NJ, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4553-8 (15 April 1983).
Four-wave mixing from a regular array of uniformly shaped and sized silver particles has been observed. The measured conversion efficiency yields an enhancement in the particles' third-order polarizability by a factor of 900 over that of the bulk metal, and is found to be in satisfactory agreement with the enhancement of the spontaneous Raman scattering from molecules adsorbed on the same samples. (13 refs.)

71183 Second harmonic generation in centro-symmetric semiconductors. D.Guidotti, T.A.Driscoll, H.J.Gerritsen (Phys. Dept., Brown Univ., Providence, RI, USA).
Solid State Commun. (USA), vol.46, no.4, p.337-40 (April 1983).
Second harmonic generation is observed in Si and Ge at electron-hole plasma densities of 10^{21}-10^{22} cm^{-3} and found to depend strongly on crystal orientation. The authors suggest that a lower crystal symmetry within the absorption volume is consistent with a model in which depletion of covalent bond charge and subsequent lattice softening, is brought about by laser excitation of a high density of electrons into antibonding states. (12 refs.)

71184 Theory of generation and amplification of Stokes and anti-Stokes waves in gaseous media. N.E.Kornienko, A.M.Steba, V.L.Strizhevskii (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1475-9 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2271-80 (Nov. 1982). [received: May 1983]
A theoretical analysis is made of generation and amplification of Stokes and anti-Stokes waves in gaseous media allowing for Raman and parametric processes and saturation effects. Allowance is also made for any difference between the Raman polarizabilities of the Stokes and anti-Stokes waves which may be caused in particular by the occurrence of one-photon quasiresonances of the interacting waves. Assuming that pump and Stokes (or anti-Stokes) waves are applied at the entrance to a medium (inverted or uninverted), a general solution is found for the amplitudes of the interacting waves under exact resonance and phase-matching conditions. This is used as the basis to investigate their spatial evolution (in particular, for inverse Raman light scattering) and expressions are found for the maximum efficiencies for conversion of the pump to Stokes and/or anti-Stokes waves. It is shown that depending on the relationship between the Raman polarizabilities and also on the input parameters of the waves, conditions of parametric bleaching of the medium with nonzero amplitudes of all the waves or conditions of complete conversion of the pump to the Stokes and anti-Stokes waves or to one of these are established asymptotically. An investigation is made of the stability of these solutions. (12 refs.)

71185 Excitation of stimulated Raman scattering in graded-index fiber waveguides by an arbitrary Gaussian beam. V.S.Butylkin, M.F.Shalyaev (Inst. of Radio Engng. & Electronics. Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1505-7 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2316-20 (Nov. 1982). [received: May 1983]
A theoretical investigation is made of stimulated Raman scattering in graded-index fiber waveguides with a parabolic distribution of the refractive index in the transverse direction. It is assumed that a fiber is pumped by a Gaussian light beam of arbitrary width and with arbitrary focusing at the entry to the fiber waveguide. The process of stimulated Raman scattering is described by expanding the interacting waves in terms of the waveguide quasimodes which are in the form of Gauss-Hermite functions of width variable along the waveguide. Equations for the amplitudes of these functions make it possible to allow for the parametric coupling between the Stokes modes. The conditions are found for the generation of multimode and single-mode Stokes components. It is shown that the efficiency of stimulated Raman scattering is independent of the focusing of a pump beam at the entry of a fiber waveguide and that it increases on increase in the refractive index gradient. (11 refs.)

71186 Initiation of laser chemical reactions by automatic phase locking in stimulated Raman scattering in a molecular gas. G.A.Abakumov, S.P.Shaitanov (L.Ya. Karpov Physicochem. Sci.-Res. Inst., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1507-9 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2320-3 (Nov. 1982). [received: May 1983]
An analysis is made of the possibility of using stimulated Raman scattering in a biharmonic visible or ultraviolet field for the excitation of one of two coupled anharmonic molecular modes whose sum frequency is close to the difference frequency of the biharmonic field. The coupling between the modes and the fields is due to electrooptic anharmonicity in relation to the polarizability and a resonance is maintained by automatic phase locking. It is shown that such excitation of anharmonic modes may occur at power densities of the field harmonics ~10 MW/cm^2 or less. A system of equations of motion is derived for the process under discussion. (9 refs.)

71187 Generation of tunable picosecond pulses in the ultraviolet and blue-green parts of the spectrum with the aid of a distributed-feedback dye laser. A.N.Rubinov, I.Chesnulyavichus, T.Sh.Efendiev (Inst. of Phys., Acad. of Sci., Minsk, Belorussian SSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1533-5 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2351-2 (Nov. 1982). [received: May 1983]
An experimental investigation was made of the conversion of the radiation of a distributed-feedback dye laser to the ultraviolet and blue-green parts of the spectrum by the methods of frequency doubling and mixing, resulting in generation of picosecond pulses. The shortest wavelength emitted so far from distributed-feedback dye lasers was 272 nm. (6 refs.)

Spectral resolution of a proustite upconverter as an infrared spectrometer .... See Entry 70129

Real-time holography and wave-front conjugation by stimulated scattering .... See Entry 71089

Generation of picosecond pulses in an injection laser with an external selective resonator .... See Entry 71137

Theoretical and experimental aspects of the nonlinear spectroscopy of biexcitons in CuCl .... See Entry 72320

Resonance-Raman scattering and electron-phonon coupling in the cuprous halides .... See Entry 72807

42.65F Phase conjugation

71188 Polarization rotation of degenerate four-wave mixing in an external magnetic field. Fu Pan-ming, Mi Xin (Inst. of Phys., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.14-20 (Jan.-March 1983). [received: May 1983]
The authors have discussed the polarization rotation of degenerate four-wave mixing in an external magnetic field. The third-order nonlinear susceptibility $\chi_{yxxx}{}^{(3)}$ is calculated in the $J_g=0\rightarrow J_e=1$ transition. It consists of two components. The first component is due to the saturation effect of the population difference. The second component is due to the Zeeman coherence induced in the interaction between atom and field. (6 refs.)

71189 Theory of degenerate four-wave mixing in picosecond excitation-probe experiments. B.S.Wherrett (Dept. of Phys., Heriot-Watt Univ., Edinburgh, Scotland), A.L.Smirl, T.F.Boggess.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.680-9 (April 1983).
A comparative theoretical study of the transient grating coherent effects in resonant picosecond excitation-probe experiments is presented. Signals in both the probe and conjugate directions are discussed. The effects of recombination, nonradiative scattering, and spatial and orientational diffusion are included. The analysis is applied to both a molecular and a semiconductor model. Signal contributions from concentration and orientational gratings are distinguished and their temporal natures discussed. From the solid-state point of view it is shown that state-filling and, in particular, anisotropic state-filling, can be identified from the configuration and time dependence of the detected signal, and thereby establish a theoretical explanation for recent observations in germanium. (29 refs.)

71190 Scattering theory of distortion correction by phase conjugation. G.S.Agarwal (Joint Inst. for Lab. Astrophys., Univ. of Colorado & NBS, Boulder, CO, USA), A.T.Friberg, E.Wolf.
J. Opt. Soc. Am. (USA), vol.73, no.5, p.529-38 (May 1983).
The correction of wave distortions by the technique of optical phase conjugation is examined first on the basis of a newly derived integral equation for scattering of monochromatic scalar waves in the presence of a phase-conjugate mirror. The solution is developed in an iterative series, and the first- and second-order terms are analyzed and illustrated diagrammatically. A generalization of the integral equation is then presented, which takes into account the electromagnetic nature of light. It is also shown that, if the conjugate wave is generated without losses or gains and with a complete reversal of polarization, a total elimination of distortions may be achieved by this technique under circumstances that frequently occur in practice. (20 refs.)

71191 Transient behavior of Kerr-like phase conjugators: the inverse problem. B.R.Suydam (Los Alamos Nat. Lab., Los Alamos, MN, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.539-47 (May 1983).
In earlier work, the transient response of a four-wave optical phase conjugator was studied. Here the author studies the inverse problem namely: how must one tailor the input pulse in order to obtain a prescribed conjugator output? The author finds that an arbitrarily short output pulse can be obtained and shows how the input, or probe, must be programmed in order to achieve this result. (18 refs.)

71192 Theory of a self-pumped phase conjugator with two coupled interaction regions. K.R.MacDonald, J.Feinberg (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.548-53 (May 1983).
The authors present a plane-wave analysis of a recently demonstrated self-pumped phase conjugator. This device uses four-wave mixing to produce the

phase-conjugate replica of an incident optical wave. All the waves are derived from the single incident wave: there are no externally supplied pumping beams. The authors consider the cases of four-wave mixing in two interaction regions coupled by simple reflection. The authors calculate the phase-conjugate reflectivity as a function of coupling strength taking into account imperfect coupling between the two interaction regions, and show that there is a threshold coupling strength below which the reflectivity is zero and above which the reflectivity is multiple valued. The authors also compute the coupling strength per unit length for a photorefractive crystal of barium titanate. (17 refs.)

71193 Modes of phase-conjugate resonators with bounded mirrors. P.A.Belanger, C.Pare, M.Piche (Dept. de Phys., Univ. Laval, Laval, Quebec, Canada).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.567-71 (May 1983).
The diffraction losses of phase-conjugate resonators with bounded mirrors are shown to depend only on two dimensionless parameters. The hemispherical phase-conjugate resonator is shown to yield a fundamental mode with minimum loss among all phase-conjugate resonators with the same mirror dimensions. Proof is given that the diffraction losses around the phase-conjugate mirror are larger than the diffraction loses around the conventional mirror; hence diffraction coupling is more efficient around the phase-conjugate mirror. Numerical results support these conclusions. (9 refs.)

71194 Three-dimensional phase-conjugate-resonator performance. G.C.Valley (Hughes Res. Labs., Malibu, CA, USA), D.Fink.
J. Opt. Soc. Am. (USA), vol.73, no.5, p.572-5 (May 1983).
The Fox-Li iterative method [Bell Syst. Tech. J., vol.40, p.253, 1961] is used to find solutions for a three-dimensional phase-conjugate resonator with a saturation gain, a random aberrator, and a pinhole spatial filter. The performance of such a resonator is excellent for resonator Fresnel numbers as small as 5 and for phase-error standard deviations as large as 2π. The use of a spatial filter to control the transverse mode shape is demonstrated. (20 refs.)

71195 Generalized mode theory of conventional and phase-conjugate resonators. M.Nazarathy (Dept. of Electrical Engng., Stanford Univ., Stanford, CA, USA), A.Hardy, J.Shamir.
J. Opt. Soc. Am. (USA), vol.73, no.5, p.576-86 (May 1983).
The phase-conjugation operator is investigated in the context of the canonical operator theory of first-order optics which was introduced in a previous series of articles. The matrix representation of this operator and its action on the generalized modes are derived, elucidating the relation between forward and reversed propagation in this new context. The resulting formalism makes possible the derivation of the eigenmodes of conventional and phase-conjugated resonators with loss or gain. Various resonator properties—confinement, stability, mode biorthogonality, and real or complex character of the spot-size parameter—simply follow from the guiding-ray-label representation. (32 refs.)

71196 Nonideal phase-conjugate resonators—a canonical operator analysis. M.Nazarathy (Dept. of Electrical Engng., Stanford Univ., Stanford, CA, USA), J.Shamir, A.Hardy.
J. Opt. Soc. Am. (USA), vol.73, no.5, p.587-93 (May 1983).
An unfolded equivalent model is constructed for the round-trip transfer operator of a phase-conjugate mirror (PCM) resonator with a cavity described by complex ABCD ray matrix elements, taking into account hard-edge mirror apertures and the possible frequency shift of the wave reflected by the PCM. The treatment makes use of recently developed canonical operator techniques and extends these methods further to incorporate wavelength variation and the effect of apertures. (22 refs.)

71197 Phase conjugation of a bulk wave by surface plasmons. K.Ujihara (Inst. for Modern Optics, Univ. of New Mexico, Albuquerque, NM, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.610-16 (May 1983).
Phase conjugation of a plane-polarized bulk wave by surface plasmons on a metal surface coated with an isotropic and transparent nonlinear dielectric is considered. The expressions for the *s*- and *p*-polarized phase-conjugate waves are given for arbitrary angle of incidence and arbitrary polarization direction of the probe wave and an arbitrary direction of propagation of two counterpropagating pump waves of surface plasmons. The reaction of the phase-conjugate wave on the probe wave is not taken into account. A reflectivity of the order of 10^{-4} is expected for a vacuum-CS_2-Ag system at ruby-laser frequency. (18 refs.)

71198 Thermally induced phase-conjugation efficiency and beam-quality studies. M.H.Garrett, H.J.Hoffman (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.617-23 (May 1983).
Aspects of thermally induced nonlinearities in the index of refraction are investigated for the case of degenerate four-wave mixing (DFWM). An expression for the reflectivity is derived within the framework of a coupled thermodynamic-electromagnetic theory, and some implications for the conjugation efficiency are briefly discussed. The authors also report on experimental measurements of phase-conjugate reflectivites in excess of 200% at 532 nm and comment on the role of saturation effects and pump delays in obtaining the observed efficiencies. Finally, the results of near-field conjugation beam-quality studies are presented with a view toward examining some of the parameters crucial to conjugation fidelity in typical DFWM experimental setups. (17 refs.)

71199 Degenerate four-wave mixing in *p*-type germanium: an absorbing medium. D.E.Watkins, C.R.Phipps,Jr. (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.624-8 (May 1983).
The authors present the results of degenerate four-wave mixing (DFWM) studies in three samples of *p*-type Ge with a wide range of absorptive properties. Three mechanisms for DFWM are observed in this material. A model, which includes the mechanisms of the inhomogeneously broadened saturable absorption of *p*-type Ge and the optical Kerr effect that is due to bound electrons in Ge but not the mechanism of bulk plasma formation that occurs only at extremely high pump intensities is developed and compared with the experimental results. Pump-beam attenuation by the medium is shown to be an important effect in modeling DFWM. The model, which has no free parameters, fits the experimental data well for samples with small-signal transmission of greater than 20%. (9 refs.)

71200 Absorption and depletion effects on degenerate four-wave mixing in homogeneously broadend absorbers. W.P.Brown (Hughes Res. Labs., Malibu, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.629-34 (May 1983).
The coupled equations satisfied by the pump, probe, and signal waves in a four-wave interaction in a two-level saturable absorber are derived, taking into account the effects of absorption and depletion. Numerical solutions of these equations are presented in two limits; one in which the probe-wave amplitude is small compared with that of the pump waves and another in which the probe- and pump-wave amplitudes are comparable. The results indicate that absorption effects are important when the wave amplitudes are less than the saturation amplitude of the absorption process. The importance of the depletion effects depends on the type of four-wave interaction. The most significant effects occur when the undepleted theory predicts probe-wave reflectivities exceeding unity. (6 refs.)

71201 Theory of saturated line shapes in phase-conjugate emission by resonant degenerate four-wave mixing in Doppler-broadened three-level systems. D.Bloch, M.Ducloy (Lab. de Phys. des Lasers, Univ. Paris-Nord, Villetaneuse, France).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.635-46 (May 1983).
The authors present a theoretical study of phase-conjugate (PC) emission by backward degenerate four-wave mixing (DFWM) processes in a resonant gas medium. In this study, high-intensity (pump) saturation and Doppler broadening are simultaneously taken into account. The authors develop a general formalism to deal with the saturation effects in the case of a three-level atom (with degenerate frequencies) and obtain analytical expressions of the PC field amplitude (after integration over the velocity distribution) under the following conditions: (1) the probe beam and one of the pump beams have intensities weak enough to be treated at the lowest perturbation order, whereas the other pump intensity is arbitrarily high; (2) the probe crosses the standing pump wave at grazing incidence. It is shown that the saturation induced by the forward pump (copropagating with the probe beam) leads to entirely different behaviour of the nonlinear susceptibility from that induced by the backward pump (counterpropagating with the probe beam). This saturation anisotropy is specific to the inhomogeneous broadening of the gas medium, which is also responsible for the frequency splitting experimentally observed in the intensity line shape of the PC emission or large pump intensities. At saturation, this splitting is theoretically shown to be proportional to the Rabi frequency, with a proportionality coefficient critically dependent on the relaxation processes: in the case of a single-relaxation model, the splitting is equal to 1.5 times the Rabi frequency. The PC intensity line shape is demonstrated to be of disperive origin in the case of backward saturation whereas for forward saturation, narrow structures are predicted in both real and imaginary parts of the nonlinear susceptibility, also leading to the intensity line-shape splitting. (38 refs.)

71202 Degenerate four-wave mixing in semiconductor-doped glasses. R.K.Jain, R.C.Lind (Hughes Res. Labs., Malibu, CA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.647-53 (May 1983).
The authors report degenerate four-wave mixing (DFWM) of visible radiation in borosilicate glasses doped with crystallites of the mixed semiconductor CdS_xSe_{1-x}. These semiconductor-doped glasses—available commercially in the form of colored glass filters—exhibit third-order nonlinearities of $\sim 10^{-9} = 10^{-8}$ esu for DFWM with short ($\sim$10-nsec) laser pulses at various visible wavelengths. The authors studies on the temporal decay of the transient gratings indicate that the nonlinearity is not thermal in origin but may be attributed to the generation of a short-lived electron-hole plasma. In contrast with DFWM experiments in other semiconductors invoking gratings of optically generated carriers (or other mobile particles), the authors report unique diffusion-independent decay of the gratings in these glasses; this is deduced from the dependence of the intensity and polarization of the DFWM signal on the polarization combinations of the input beams. Finally, the authors report detailed data on the aberration-correction properties of these isotropic glasses. (33 refs.)

71203 Intracavity resonant degenerate four-wave mixing; bistability in phase conjugation. G.P.Agrawal (Dept. of Phys., City Coll., City Univ of New York, New York, NY, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.645-60 (May 1983).
A general formalism is developed to study intracavity phase conjugation through resonant degenerate four-wave mixing. The effects of spatial hole burning arising from interference of the counterpropagating pump waves, are fully incorporated. The analysis is applied to discuss intracavity phase conjugation in nonlinear media that can be modeled using either a two-level system or a Λ-type three-level system. In both cases, the phase-conjugate reflectivity exhibits bistability for an appropriate choice of the input parameters. For a two-level system, the tuning characteristics of the Fabry-Perot cavity significantly affect the phase-conjugate spectrum that displays hysteresis when the cavity is detuned from the applied laser frequency. (28 refs.)

71204 Compensation of phase distortions in a single-transit wavefront-reversal system with a degenerate four-photon interaction. M.S.Barashkov, I.N.Matveev, V.M.Petnikova, A.F.Umnov, N.D.Ustinov, V.V.Shuvalov.
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1524-5 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2340-1 (Nov. 1982). [received: May 1983]
A proposal is made for a system designed to compensate phase distortions in a wavefront-reversal system in which some part of the signal radiation is deflected to pass through a spatial frequency filter and then acts as the pump; the remainder of such radiation acts as the signal. It is shown that a suitable selection of the pass band of the filter can ensure compensation of large-scale phase inhomogeneities in the system and can enable reconstruction of a small-scale structure of an object. (2 refs.)

Wave-front dislocations: topological limitations for adaptive systems with phase conjugation .... See Entry 71071

Effects of partial wave-front reversal during the reflection of waves in randomly inhomogeneous media .... See Entry 71075

Real-time holography and wave-front conjugation by stimulated scattering .... See Entry 71089

Saturation effects in phase-conjugate lasers .... See Entry 71101

Power and stability of phase-conjugate lasers .... See Entry 71102

Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide .... See Entry 71181

Interferometric sensor using phase conjugate mirrors .... See Entry 71246

42.65G Photon echoes, self-induced transparency, optical saturation and related effects

71205 Prolongation structure for the reduced Maxwell-Bloch equations describing the two-photon self-induced transparency. A.I.Maimistov, E.A.Manykin (Moscow Engng. Phys. Inst., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.216-18 (2 May 1983).
The reduced two-photon Maxwell-Bloch equations are shown to have the nontrivial prolongation structure of Wahlquist and Estabrook (see J. Math. Phys., vol.16, p.1, 1975). As a result, the associated Lax representation is determined. (12 refs.)

71206 Elliptical billiard-ball echo model. R.Beach, B.Brody, S.R.Hartmann (Dept. of Phys., Columbia Univ., New York, NY, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2537-47 (May 1983).
The billiard-ball echo model is expanded to include the effects of using sub-Doppler-linewidth lasers in photon-echo experiments. The simple heuristic model which emerges explains such echo phenomena in gases as the echo time width and the degradation of echo intensity with angling of the excitation pulses. The authors derive simple results in the small-pulse-area limit and give formal expressions for excitation pulses of arbitrary area. (3 refs.)

Saturation effects in phase-conjugate lasers .... See Entry 71101

Ultrashort pulse propagation in saturable media: a simple physical model .... See Entry 71149

Pulse shaping in passively mode-locked ring dye lasers .... See Entry 71150

Passive mode locking of flashlamp-pumped dye lasers in the 508-583 nm range .... See Entry 71154

Spectral development of Picosecond pulses of mode-locked Nd-glass lasers .... See Entry 71155

Power characteristics of an He-Ne laser utilizing the $3s_2$-$2p_6$ transition in neon (λ=612 nm) and containing a $^{127}I_2$ absorption cell .... See Entry 71169

Three-dimensional phase-conjugate-resonator performance .... See Entry 71194

Thermally induced phase-conjugation efficiency and beam-quality studies .... See Entry 71198

Degenerate four-wave mixing in *p*-type germanium: an absorbing medium .... See Entry 71199

Absorption and depletion effects on degenerate four-wave mixing in homogeneously broadend absorbers .... See Entry 71200

Theory of saturated line shapes in phase-conjugate emission by resonant degenerate four-wave mixing in Doppler-broadened three-level systems .... See Entry 71201

Intracavity resonant degenerate four-wave mixing; bistability in phase conjugation .... See Entry 71203

42.65J Beam trapping, self focusing, thermal blooming, and related effects

71207 Self-focusing of Gaussian beams: an alternate derivation. P.-A.Belanger, C.Pare (Dept. de Phys., Univ. Laval, Quebec City, Quebec, Canada).
Appl. Opt. (USA), vol.22, no.9, p.1293-5 (1 May 1983).
It is shown that self-focusing can be taken into account in an optical paraxial system by simply defining a new generalized radius of curvature, namely $1/q^{NL}=1/R-[j(\sigma^{1/2})/\pi W^2]\lambda$ where $(\sigma-1)$ is the ratio of the power of the beam to the critical power for self-focusing. (4 refs.)

71208 Examination of ultrarapid relaxation in a medium by space-time modulation of the perturbing light. M.A.Vasil'eva, V.I.Malyshev, A.V.Masalov, P.S.Antsiferov (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.167-70 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1203-7 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
Ultrashort light pulses are traditionally used to measure picosecond relaxation times, and the lengths of these should be substantially less than the relaxation times. However, at present the production of ultrashort light pulses is complicated. The authors describe a method of measurement that does not require such pulses. This has been used to measure relaxation times for some bleaching dyes. A laser with a broad generation spectrum constituted by a large number of fluctuation excursions was used. The essence of the method consists in examining the self-diffraction of the beams on passing through the medium. The following scheme is used to examine the self-diffraction. A medium with nonlinear response (a solution of a bleaching dye) placed in the region of intersection of two light beams was examined. The light produces a bleaching lattice in the dye in accordance with the interference structure from the overall field of the incident beams. In that case, the passage of the beams through the medium is accompanied by self-diffraction, i.e. diffracted beams deviated by a definite angle observed at the exit. (5 refs.)

Real-time holography and wave-front conjugation by stimulated scattering .... See Entry 71089

Pulsed gain and thermal lensing of Nd:LiYF$_4$ .... See Entry 71130

Transient behavior of Kerr-like phase conjugators: the inverse problem .... See Entry 71191

Degenerate four-wave mixing in *p*-type germanium: an absorbing medium .... See Entry 71199

Intense laser self-focusing in plasmas .... See Entry 71745

42.70 OPTICAL MATERIALS

71209 A close look at optical plastics. II. Manufacturing and production tolerances. H.D.Wolpert (Xerox Electro-Optical Systems, Pasadena, CA, USA).
Photonics Spectra (USA), vol.17, no.3, p.63-6 (March 1983).
For pt.I see ibid., vol.17, no.2, p.68-71 (1983). Discusses the production injection molding tolerances generally achieved for low cost commercial and precision components. There are also some thoughts on optical coatings for plastic lenses and cleaning. (16 refs.)

Statistical trends in laser damage .... See Entry 71161

Column structure of dielectric evaporated layers and some of their properties .... See Entry 72260

The temperature dependence of the refractive indices of fused silica and crystal quartz .... See Entry 72749

Electroabsorption by Stark effect on room-temperature excitons in GaAs/GaAlAs multiple quantum well structures .... See Entry 72769

Electro-optic effects of (Pb, La)(Zr, Ti)O$_3$ thin films prepared by RF planar magnetron sputtering .... See Entry 72770

The role of rate of deposition and substrate temperature on the structure and loss of zinc sulphide and magnesium fluoride films .... See Entry 72879

42.70C Glass

Changes of refractive index in glass induced by UV-irradiation and a new possibility of their determination .... See Entry 70107

An optical discharge in a condensed medium .... See Entry 71159

Degenerate four-wave mixing in semiconductor-doped glasses . See Entry 71202

Preparation of germanate glass by vapor-phase axial deposition .... See Entry 71259

The temperature dependence of the refractive indices of fused silica and crystal quartz .... See Entry 72749

Measurements of visual light scattering in glass electrets .... See Entry 72823

Effect of aluminum content on infrared characteristics of BaF$_2$/ThF$_4$-containing glasses .... See Entry 72838

Development of porous antireflective films on borosilicate glasses .... See Entry 73238

42.70G Light-sensitive materials

Kodacolor VR 1000 film .... See Entry 70131

Spectral dependence of reversible optically induced transitions in organometallic compounds .... See Entry 71172

42.72 OPTICAL SOURCES AND STANDARDS

(for spectroscopic light sources, see also 07.65)

71210 Fast-acting optical radiation source. A.S.Prokhorenko, N.N.Shavel' (Sci.-Res. Inst. of Appl. Phys. Problems, State Univ., Minsk, Belorussian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1004-6 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.202-4 (July-Aug. 1982). [received: May 1983]
Characteristics are presented for light-diodes based on GaAs tunnel diodes. For pumping current pulse amplitudes >1 Å the lag in optical radiation is ≤0.1 nsec. The rise time of the transient radiation intensity characteristics of the light diodes is 0.08-0.2 nsec for different pieces. Recommendations are given on the exploitation of the described light diodes. (5 refs.)

71211 The CSI 1000 W lamp as a source for solar radiation simulation. P.Krusi, R.Schmid (Dept. of Mech. Engng., Univ. of Sydney, Sydney, NSW, Australia).
Sol. Energy (USA), vol.30, no.5, p.455-62 (1983).
In recent years the Thorn manufactured CSI 1000 W lamp has been employed as radiation source for a number of solar simulators to test solar collectors. Claimed properties such as good spectral match to air mass two solar spectrum and long lifetime (1000 hr) as well as features like built-in and sealed reflector, ease of electrical control, relatively low cost per unit luminous flux and low running cost seem to render the CSI lamp ideal for collector testing. The objective of the note is to analyze these properties of the CSI lamp and to compare them with the ASHRAE requirements for solar simulators. (9 refs.)

Pulsed source of an optical comparison spectrum of high brightness .... See Entry 70120

Unified supply source for lamps used in ultraviolet spectroscopy .... See Entry 70125

Spectral resolution of a proustite upconverter as an infrared spectrometer .... See Entry 70129

Operation of krypton-filled flashlamps at high repetition rates .... See Entry 71134

42.78 OPTICAL LENS AND MIRROR SYSTEMS

(for microscopes, see 07.60P; for photographic instruments, see 07.68; for astronomical telescopes, see 95.55)

71212 Optimisation of input variables of reflecting prisms with normal incidence of the paraxial ray of a beam at the point of input. J.Klabazna.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.3, p.79-83 (March 1983). In Czech.
Describes a method for optimal design of optical systems with regard to minimisation of the prism geometry. The following problems are dealt with and illustrated with examples: intersection of a plan-parallel plate and cone; and intersection of a coaxial plan-parallel plate, cylinder and cone. *E.D.*

71213 Measurements of the distribution of the flux of energy in the focus of a solar concentrator with visualization techniques. P.Ottonello, G.A.Rottigni (Istituto di Sci. Fisiche., Univ. di Genova, Genova, Italy).
Nuovo Cimento C (Italy), vol.5C, ser.1, no.5, p.515-27 (Sept.-Oct. 1982). [received: May 1983]
Analyses the setting-up of an optical head which allows the visualization of a section of the distribution of the flux of energy along the focal axis of optical systems in general and of solar concentrators in particular. A circular-type concentrator, with the reflector consisting of a plastic lamina aspirated by means of a pump, has been built. The distribution of the energy flux in the focus of this concentrator has been calculated theoretically. Results are compared with experimental data obtained by means of the optical head. (11 refs.)

71214 Geometrical concentration characteristics of a linear Fresnel reflector using a fin receiver. A.K.Singhal, R.N.Singh (Dept. of Phys., Indian Inst. of Technol., New Delhi, India), T.C.Kandpal, S.S.Mathur.
Opt. Appl. (Poland), vol.12, no.3-4, p.273-81 (1982).
The possibility of using a fin receiver with a linear Fresnel reflector has been explored. The geometrical design and performance characteristics of such a concentrator-receiver system have been studied. Numerical calculations have been made for some typical concentrator-receiver designs. Results are plotted graphically and discussed. (7 refs.)

71215 Geodetic and two-layer lenses based on dielectric diffusion light-guides. J.Kruszewski, M.Gutkowski, K.Jedlinski (Inst. of Electron Technol., Tech. Univ. of Warsaw, Warsaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.293-301 (1982).
Describes the production methods for two types of lenses used in integrated optics, i.e. the geodetic and hybrid two-layer lenses. Also, the authors present the element parameters. (6 refs.)

71216 Correcting method for light scanning error of rotating polygonal mirror. T.Matsuda, T.Mikami, F.Abe (Peripheral Devices Lab., Fujitsu Labs. Ltd., Kawasaki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.2, p.137-44 (Feb. 1983). In Japanese.
An electrical correcting method for light scanning error caused by a rotating polygonal mirror is described. Rotating polygonal mirrors are widely used in image input/output equipment. The authors show that light scanning error caused by facet flatness error is corrected by compensating the period of a pixel control clock in accordance with a light scanning time measured at each scanning. It is also shown that variation of light scanning velocity is simultaneously compensated. The correcting method has been successfully applied to a laser printer with high printing speed and high resolution. (11 refs.)

Scanning mirror device with frequency matching for the DFS-13 spectrograph .... See Entry 70121

Effects of partial wave-front reversal during the reflection of waves in randomly inhomogeneous media .... See Entry 71075

Augmented laser scan equations for lenticular or holographic elements .... See Entry 71086

Reflective optics system for multiple beam laser fusion .... See Entry 71171

Thin-film elements of structure containing wedge optical transition .... See Entry 71218

Interferometric sensor using phase conjugate mirrors .... See Entry 71246

Integrated optics: strides toward the single chip .... See Entry 71256

Enhancement of radiation cooling by means of reflectors .... See Entry 71339

Ideal second stages in tandem with spherical mirrors .... See Entry 73417

The design and performance of ideal solar concentrators based on the prism-assisted cyclindrical reflector .... See Entry 73421

Optical properties of compound elastical concentrators .... See Entry 73423

Photovoltaic concentrator module characterization .... See Entry 73460

42.78H Coatings

71217 Calculation of the reflectivity of multilayer dielectric TiO_2-SiO_2 mirrors at 1.06 microns using the diagram technique. Ya.O.Dovgii, B.V.Mikityuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.62-4 (1983). In Ukrainian.
Reflectivity spectra of multilayer dielectric TiO_2-SiO_2 mirrors are calculated using a circle diagram technique. The given techniques are shown to provide the necessary accuracy and may be successfully used for other systems. (2 refs.)

Device for observing microheterogeneities in interference coatings .... See Entry 70111

Multilayer films for soft X-ray optics .... See Entry 70164

A close look at optical plastics. II. Manufacturing and production tolerances .... See Entry 71209

Development of porous antireflective films on borosilicate glasses .... See Entry 73238

42.80 OPTICAL DEVICES, TECHNIQUES AND APPLICATIONS

(for optical instruments and techniques, see 07.60; for optical spectroscopy, see 07.65; for photography, see 07.68; for holography, see 42.40; for lasers, see 42.55 and 42.60; for masers, see 42.52)

71218 Thin-film elements of structure containing wedge optical transition. J.Kruszewski, M.Gutkowski (Inst. of Electron Technol., Univ. of Warsaw, Warsaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.283-92 (1982).
The concept of optical thin film elements presented is followed by a discussion of the fundamentals of thin-film optics. The authors then present a review of both the technology and materials used for thin film elements. (16 refs.)

71219 Thin-film optical components of hybrid structure formed of Ta_2O_5 on a diffusion lightguide. J.Kruszewski, M.Gutkowski (Inst. of Electron Technol., Tech. Univ. of Warsaw, Warsaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.427-31 (1982).
A new structure useful for thin film optical components is elaborated. It is a hybride-formed Ta_2O_5 island in the window of planar diffusion lightguide. Some attempts have been made to apply this structure to lens and prism formation. The results have proved positive. (4 refs.)

Imaging of a two-point object in an apodized optical system. Theory and analog examination .... See Entry 71084

Fringe benefits: applications of holographic elements .... See Entry 71088

Optimisation of input variables of reflecting prisms with normal incidence of the paraxial ray of a beam at the point of input .... See Entry 71212

42.80B Spatial filters, zone plates

71220 Size-sensitive filters. D.Eberlein, A.Schwerdtner (Ingenieurhochschule Dresden, Dresden, Germany).
Opt. Appl. (Poland), vol.12, no.3-4, p.317-27 (1982).
Presents a method for obtaining spatial frequency filters which are highly sensitive to variations in size, shape, and orientation of objects. The filter effects a phase change of the incident object wave and is strongly dependent on the object expected in the input plane. For real symmetric objects the filters become simple phase masks. (12 refs.)

Compensation of phase distortions in a single-transit wavefront-reversal system with a degenerate four-photon interaction .... See Entry 71204

42.80C Spectral and other filters

71221 Birefringent filter temperature sensor. J.M.Knox, P.M.Marshall (Heriot Watt Univ., Edinburgh, Scotland), R.T.Murray.
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.1-5
Describes how a lithium niobate $LiNbO_3$ birefringent filter can be used as a temperature sensor by analysis of the change in its optical transmission spectrum with temperature. A preliminary system has been made using fibre optic transmission to and from the sensor. (15 refs.)

Fringe benefits: applications of holographic elements .... See Entry 71088

42.80D Monochromators

71222 Simple mechanism for in situ adjustment of gratings in UHV monochromators. W.A.M.van Bers, A.J.J.Franken, P.K.Larsen (Philips Res. Labs., Eindhoven, Netherlands).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.637-8 (May 1983).
A mechanism is described for adjustment under ultrahigh vacuum of the optical alignment of gratings in a vertically dispersing grazing incidence monochromator. The mechanism is based on two pairs of broad leaf springs and it allows rotation of the grating, of up to one degree, around two mutually perpendicular axes with respect to the photon energy scan axis. Measurements for a grazing incidence monochromator show that to achieve optimum resolution the adjustment of the grating should be better than 0.1°. (2 refs.)

Device for observing microheterogeneities in interference coatings .... See Entry 70111

Picosecond spectrochronography .... See Entry 70124

42.80E Shutters, windows, diaphragms, deflectors, choppers

High-speed optical Fourier transformer .... See Entry 71078

42.80F Gratings, echelles

71223 Optical polarizers for the ultraviolet. G.J.Sonek, D.K.Wagner, J.M.Ballantyne (Nat. Res. & Resource Facility for Submicron Structures, Cornell Univ., Ithaca, NY, USA).
Appl. Opt. (USA), vol.22, no.9, p.1270-2 (1 May 1983).
Large area ($\sim$6-cm^2) planar optical polarizers have been fabricated which polarize at deep UV wavelengths and are at the same time highly transmissive. The double-shadowing technique has been employed to generate parallel plate waveguide structures with periodicities of 1150 Å and an operating wavelength of 2000 Å. Transmission of better than 57% and extinction ratios of 0.41 have been achieved by these UV grating polarizers. The SiO_2 gratings fabricated have periods of 2300 Å and linewidths of 900 Å. The deposition of 250 Å of aluminium along the grating sidewalls produces waveguide structures whose metallic plates are separated by 900 Å. (5 refs.)

Mathematical analysis of gratings with circularly concentric grooves .... See Entry 71069

Fringe benefits: applications of holographic elements .... See Entry 71088

Meridional light path function and coma transfer for corrected holographic concave gratings .... See Entry 71092

Theory of degenerate four-wave mixing in picosecond excitation-probe experiments .... See Entry 71189

Simple mechanism for in situ adjustment of gratings in UHV monochromators .... See Entry 71222

Fabrication and investigation of thin-film CdS_xSe_{1-x} waveguides .... See Entry 71233

42.80K Optical beam modulators

71224 Use of an ADP four-crystal electrooptic modulator in ellipsometry. A.Moritani, Y.Okuda, J.Nakai (Dept. of Electronic Engng., Osaka Univ., Osaka, Japan).
Appl. Opt. (USA), vol.22, no.9, p.1329-36 (1 May 1983).
Some theoretical considerations and experimental techniques in application of an ADP 45° X-cut four-crystal electrooptic modulator (EOM) to fast retardation modulation ellipsometry are described, emphasis being placed on the thermal stabilization. First to solve the thermal instability problem and to analyze systematic errors resulting from use of the EOM, the Jones matrix for the EOM is theoretically constructed which includes the effect of axial misalignment of the ADP crystals, multiple reflection at crystal-matching-dielectric liquid interfaces, temperature differences among the four crystals, and modulator cell windows. As a result, temperature-dependent factors in EOM characteristics are made clear. Second, a practical matrix form of the Jones matrix is determined from experiments on the bias-voltage dependence of the transmitted light intensity. Last, a thermal stabilization technique introduced by the matrix representation is demonstrated in the application of the EOM to ellipsometry, which enables one to obtain ellipsometric parameters of a sample, (Ψ,Δ), independent of the thermal drift and imperfections that accompany the EOM. (21 refs.)

71225 Electro-optical light modulation in InGaAsP/InP double heterostructure diodes. H.G.Bach, J.Krauser, H.P.Nolting (Heinrich Hertz Inst. fuer Nachrichtentech. Berlin GmbH, Berlin, Germany), R.A.Logan, F.K.Reinhart.
Appl. Phys. Lett. (USA), vol.42, no.8, p.692-4 (15 April 1983).
The linear electro-optic coefficient r_{41} was determined in quarternary double heterostructure waveguides containing a p-n junction. Over the limited range of measurements, it is independent of wavelength and composition with a value $r_{41}=-1.4\times10^{-10}$ cm/V. A strong quadratic electro-optic effect has been identified for the first time, which strongly depends on the band gap and photon energy as does the associated electroabsorption effect. (11 refs.)

71226 Subpicosecond electrical sampling. J.A.Valdmanis, G.A.Mourou, C.W.Gabel (Lab. for Laser Energetics, Univ. of Rochester, Rochester, NY, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.664-7 (April 1983).
Reports on the recent advances of an electrooptic sampling technique for the characterization of electrical transients that has now achieved an unprecedented temporal resolution of less than 1 ps. Voltage sensitivity is on the order of 50 μV. A lithium tantalate traveling wave Pockels cell is employed in conjunction with a high repetition rate subpicosecond laser system. (18 refs.)

71227 Picosecond pulse response of broad-band guided-wave interferometric light modulators. M.Izutsu, T.Sueta (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.668-74 (April 1983).
Analyzes the time responses of phase and intensity modulators of the traveling-wave type, and the modulated output waveforms related to the modulating pulses are discussed. It is shown that there is an optimum interaction (or electrode) length of the modulator whereby the drive voltage is minimized for

a desired output pulse width. The traveling-wave push-pull light intensity modulator of Ti-diffused LiNbO$_3$ waveguides was modulated by a pulse train of 1 GHz repetition frequency, and the modulated output was observed by the image tube streak camera modified for sinusoidal scan at the same frequency. The duration of the modulated light pulses was less than 45 ps, which shows good agreement with the predicted one. (11 refs.)

71228 Effect of axial misalignment and multiple reflection on Jones matrix of a four crystal light modulator. A.Moritani, J.Nakai (Faculty of Engng., Osaka Univ., Suita, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.2, p.129-36 (Feb. 1983). In Japanese.
The authors describe the effect of axial misalignment and multiple reflection on the Jones matrix of an ADP (or KDP etc.) 45° X-cut four crystal light modulator. First, dielectric tensors of the crystals with axial misalignment are derived and then the Jones matrix representation is obtained by use of Berreman's 4×4 matrix formulation. Calculated results show that nondiagonal terms sensitive to temperature fluctuation arise from axial misalignment of the crystals and that complicated but small effect of multiple reflection at crystal-dielectric liquid interfaces appears in the diagonal terms. (9 refs.)

High-speed optical Fourier transformer .... See Entry 71078

An analysis on characteristic of the hybrid optical bistability ....See Entry 71173

Electroabsorption by Stark effect on room-temperature excitons in GaAs/GaAlAs multiple quantum well structures .... See Entry 72769

42.80L Optical waveguides

(for fibre optical waveguides, see 42.80M)

71229 Wave scattering and guidance by dielectric waveguides with periodic surfaces. S.L.Chuang, J.A.Kong (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.669-79 (May 1983).
Stratified media with periodic surfaces have been used in waveguide-input and waveguide-output couplers and distributed-feedback lasers. The authors apply the extended-boundary-condition approach to treat the problem of scattering and guidance by stratified media with period surfaces for both the Te and TM polarizations in a unified manner with the use of a transition matrix. Theoretical results are shown to compare well with the experimental data for metallic gratings with surface-plasmon excitations. The anomalous behaviour of the diffraction efficiencies is explained with the evanescent Floquet waves, which are excited with incidence angles corresponding to the locations of the dips in the total reflected efficiency plots. Diffraction efficiencies are plotted for wave scattering from corrugated thin-film waveguides with an angle of incidence near that for the waveguide-mode excitation. The guiding constants are also calculated and compared with the results obtained by other numerical methods. The origins of the imaginary parts in the guiding constants are discussed in light of the nonevanescent waves excited in the substrate. (39 refs.)

71230 Orthogonality and normalization of radiation modes in dielectric waveguides: an alternative derivation. C.Vassallo (CNET, Lannion, France).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.680-3 (May 1983).
Radiation modes in arbitrary dielectric waveguides with homogeneous cladding can be split into a free-space field having its sources at infinity and a scattered field excited by the polarization of the core region. In a recent paper, Sammut [J. Opt. Soc. Am. 72, 1335 (1982)] stated that radiation modes have the same orthogonality properties as their free-space parts in lossless waveguides. An alternative derivation is established, and connected with earlier work is also reviewed. (6 refs.)

71231 Hamiltonian analysis of beams in an optical slab guide. W.K.Kahn, S.Yang (Dept. of Electrical Engng. & Computer Sci., School of Engng. & Appl. Sci., George Washington Univ., Washington, DC, USA).
J. Opt. Soc. Am. (USA), vol.73, no.5, p.684-90 (May 1983).
The formal analogy between Hamiltonian classical mechanics and quantum mechanics on the one hand and geometrical optics and physical optics on the other hand is systematically presented. When the time is replaced by the axial coordinate of a cylindrically uniform optical system and Hamilton's principle replaced by Fermat's principle, classical particle trajectories correspond to rays and quantum-mechanical wave functions to physical-optics fields. The operator formalism of quantum mechanics then provides elegant solutions for problems associated with propagation of beams in a gradient-index multimode optical slab guide. (25 refs.)

71232 Calculation of the phase sensitivity of a thin-film controlled coupler. K.S.Buritskii, E.M.Zolotov, V.A.Chernykh (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1498-9 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2308-10 (Nov. 1982). [received: May 1983]
A calculation is made of the phase sensitivity of a controlled directional coupler based on diffused LiNbO$_3$:Ti channel waveguides. Diagrams are given for determining the value of the voltage at which the maximum phase sensitivity is obtained. (13 refs.)

71233 Fabrication and investigation of thin-film CdS$_x$Se$_{1-x}$ waveguides. Z.E.Buachidze, I.V.Vasilishcheva, V.N.Morozov, V.A.Pietnev, A.S.Semenov, P.V.Shapkin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1514-16 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2329-30 (Nov. 1982). [received: May 1983]
The diffusion method was used to fabricate CdS$_x$Se$_{1-x}$ solid-solution waveguides with losses in the range 9-13 dB/cm. The refractive index profile of these waveguides was determined. Photochemical etching of the waveguide surface was employed to form diffraction gratings with 10^3 lines/mm and a relief 40-nm deep. (7 refs.)

Radio-frequency-excited carbon dioxide metal waveguide laser ....See Entry 71138

Novel class of nonlinear surface waves: asymmetric modes in a symmetric layered structure .... See Entry 71176

Optical transistors and bistable devices utilizing nonlinear transmission of light in systems with unidirectional coupled waves ....See Entry 71177

Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide ....See Entry 71181

Geodetic and two-layer lenses based on dielectric diffusion lightguides ....See Entry 71215

Electro-optical light modulation in InGaAsP/InP double heterostructure diodes ....See Entry 71225

Picosecond pulse response of broad-band guided-wave interferometric light modulators ....See Entry 71227

Integrated optics: strides toward the single chip ....See Entry 71256

Integrated optical devices using amorphous As$_2$S$_3$ thin film ....See Entry 71257

Multistructured optical IC elements by polymer thin films ......See Entry 71258

42.80M Fibre optics

71234 Technical and economic aspects of the different fibre fabrication processes. G.J.Koel (Philips Glass Div., Eindhoven, Netherlands).
Ann. Telecommun. (France), vol.38, no.1-2, p.36-46 (Jan.-Feb. 1983).
The processes for making preforms for hard glass fibres are the VAD process, the OVD process, the MCVD (PMCVD) process and the PCVD process. This paper discusses the processes themselves, the optical properties of multimode, single-mode and high NA fibres made with these processes and the potentials of the different processes. For really large scale applications it will be necessary to reduce the costs of manufacturing these fibres. The factors that determine these costs are discussed and ways in which they can be reduced are indicated. (25 refs.)

71235 Experimental study of monomode fibres with a depressed inner cladding. J.J.Bernard, C.Brehm, J.-Y.Boniort, Ph.Dupont (Lab. de Marcoussis, CGE, Marcoussis, France), J.-M.Gabriagues, C.Le Sergent, M.Liegois, P.Francois, M.Monerie, P.Sansonetti.
Ann. Telecommun. (France), vol.38, no.1-2, p.47-52 (Jan.-Feb. 1983). In French.
This paper presents some results of an experimental investigation of fibres with a depressed inner cladding (W type). It has been confirmed that fibers with low losses and weak dispersion in the 1.3-1.7 μm range can be achieved. The sensitivity to fabrication parameters is very important. Information is given on preform fabrication and index profile measurements. (8 refs.)

71236 Progress in fiber test standards. R.L.Gallawa, D.L.Franzen.
Photonics Spectra (USA), vol.17, no.4, p.55, 58, 60, 62, 64, 66, 68 (April 1983).
Reviews the state-of-the-art in setting important standards, and prospects for the future. The authors provide a glossary of terms, fiber attenuation, fiber bandwidth, and refractive index profile, the last of which leads to the determination of core diameter. (14 refs.)

71237 OTDR puts fibers to the test. C.Flatau.
Photonics Spectra (USA), vol.17, no.3, p.47-50 (March 1983).
For general-purpose measurements, optical time domain reflectometry (OTDR) is a key technique for testing optical systems for many of the needed qualities. Typically, an OTDR instrument consists of a laser source, a beamsplitter and a photodetector. During OTDR measurement, a laser pulses an optical fiber, the reflections are directed to the photodetector, and the resulting backscatter waveform is displayed. Two types of reflection occur during the measurement: Fresnel reflection occurring at fiber breaks or fiber ends; Rayleigh scattering caused by fluctuations in atomic concentration and other glass inhomogeneities. Fresnel reflection helps in evaluating connectors and in locating fiber breaks: Rayleigh scattering, on the other hand, provides information on the attenuation of the fiber. Some waveform analysis can be done visually from the OTDR display. Signal averaging allows increased dynamic range and noise reduction, so as to permit small reflections from defects or not-so-clean fiber breaks to be revealed. (no refs.)

71238 Microbending effects on monomode light propagation in multimode fibers. F.de Fornel, J.Arnaud (Lab. d'Electronique des Microondes, Limoges Univ., Limoges, France), P.Facq.
J. Opt. Soc. Am. (USA), vol.73, no.5, p.661-8 (May 1983).
The effects of periodic axis deformations on propagation in multimode optical fibres with single-mode excitation are investigated numerically and experimentally. The numerical study, based on ray theory, deals with helical rays in the presence of sinusoidal deformations for various shapes of index profile. The corresponding experimental observations and results, carried out on tubular modes confirm the existence of resonance effects between the helical ray period and the fiber axis deformation. This technique permits the observation of mode-to-mode power transfer and provides a sensitive tool to investigate the mode-coupling mechanism in optical fibers. (6 refs.)

71239 Local detection for splice loss in optical fiber. M.Sato, N.Kashima (Ibaraki Electrical Communication Lab., NTT, Ibaraki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part B (Japan), vol.J66B, no.2, p.255-6 (Feb. 1983). In Japanese.
A leakage light distribution suitable for the detection at the near part of the splice point was obtained by covering the splice point with a high refractive index hyaline material which contains scattering matter. The relation between leakage light power and splice loss was measured. (3 refs.)

71240 Extremely low-loss optical waveguide for vacuum ultraviolet light. T.Hidaka (Electrotech. Lab., Ibaraki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.2, p.153-4 (Feb. 1983). In Japanese.
A new type of extremely low-loss optical waveguide is proposed which uses the fact that the refractive index n at vacuum ultraviolet frequency is smaller than unity due to plasma vibration of electrons. The waveguide transmission loss at 50 nm wavelength is expected to be 0.05 dB/km for 0.1 mm core waveguide. (5 refs.)

71241 Characteristics of twisted single-mode optical fiber for current sensor. M.Kuribara, Y.Takeda (Central Res. Inst. of Electric Power Industry, Komae, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.2, p.173-4 (Feb. 1983). In Japanese.
As single-mode optical fibers act as the transducer as well as the beam guide, they are useful for current measurements on high-voltage lines. One of the most significant problems for an optical current sensor using the Faraday effect is to conserve the linearly polarized light in the fiber. The authors show experimental results for the polarization conservation of twisted single-mode optical fibers and the characteristics of the sensitivity for current measurements. With this fiber, $\simeq$100 rad./m twisted, the current measurement is performed for 2 to 55 kAT. For these magnetic fields linear results are obtained, and the sensitivity of this fiber is $\simeq 2.3\times10^{-6}$ rad./AT. (5 refs.)

71242 Fiber optics sensing techniques. W.H.Quick, K.A.James, J.E.Coker.
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.6-9
A digital, fiber-optic temperature sensor using a variable Fabry-Perot cavity as the sensor element was analyzed, designed, fabricated and tested. A microprocessor based color demodulation system converts fiber-transmitted cavity reflection spectra to temperature. The complete temperature sensor system was evaluated in the laboratory. Results show that the Fabry Perot

temperature sensor has good resolution (.05% of full scale), high accuracy, and potential for high temperature (>1000°C) applications. (no refs.)

71243 Differential absorption distributed thermometer. E.Theocharous (Central Electricity Res. Labs., Leatherhead, England).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.10-12
The operation of a practical fibre optic distributed thermometer was successfully demonstrated. It relies on the strong temperature dependence of the absorption profile of the ruby glasses. A differential absorption method is employed in combination with the backscattering technique to monitor the absorption profile and thus the temperature of a number of small sensors distributed along the length of an optical fibre. (6 refs.)

71244 Sensitivity vs. size of fibre-optic interferometric sensors. R.Ulrich (Tech. Univ., Hamburg-Harburg, Germany).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.17-22
The sensitivities $S=d\phi/dx$ are compared for a number of fibre-optic interferometric sensors, all employing elastic strain in a single-mode fibre. The quantity x, which is to be measured, may be an acoustic pressure, or a magnetic or electric field strength, requiring a suitable transducing element in the form of an elastic, magnetostrictive or piezo-electric body, respectively. A variety of such sensor arrangements are considered. For many of them the sensitivity can be optimized by balancing the force produced by x and the reactive force from the elastic strain in the fibre. In all cases the optimum sensitivity at low frequencies is found to scale as $S_{opt}=\Gamma V/\lambda A_o$ with the geometric parameters of the sensor. In this relation, V denotes a characteristic volume of the transducing body, A_o is the cross-sectional area of the fibre, and λ the vacuum wavelength of the light in the interferometer. The coupling constant Γ is largely independent of the specific design (V, A_o, λ) of the sensor, it is determined mainly by material parameters. (7 refs.)

71245 Optical fibre hydrophones with down lead insensitivity. M.L.Henning, S.W.Thornton, R.Carpenter, W.J.Stewart, J.P.Dakin, C.A.Wade.
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.23-7
Describes an interferometric system in which the phase stability of an heterodyne is achieved with the simplicity of a homodyne, leading to a completely passive underwater system with no environmental noise problems on the leads to and from the sensor head. Its laboratory performance, before optimisation, is adequate for many underwater applications, and it has potential for particular use in large scale area coverage. The use of such sensors in underwater arrays is practicable and with suitable optical multiplexing it will be possible to form steerable beams. It seems reasonable to expect that eventually, performance will be adequate for the majority of underwater applications and that incorporation of integrated optical techniques will allow the full utilisation of the particular advantages of optical fibres in underwater acoustic sensors. (9 refs.)

71246 Interferometric sensor using phase conjugate mirrors. Ph.Graindorge, H.J.Arditty, H.C.Lefevre (Lab. Central de Recherches, Thomson-CSF, Orsay, France).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.28-32
The authors have proven the feasibility of a conjugate mirror fiber optic interferometric sensor, containing no optics or alignments and relying on the auto-oscillation provided by the high gain four wave mixing (photo-refractive) process in barium titanate. The self compensating properties of this scheme makes it particularly well suited to the hydrophone application. An interesting, but unexpected, self biasing has been observed and is now under investigation, and this aspect could be taken advantage of in other fiber optic sensors. The spatial conjugation capability of the photorefractive process could also allow the replacement of monomode fibers by multimode fibers when more advantageous, without losing the reciprocal behaviour characteristic of monomode fibers. The experiment was carried out at 514 nm (Ar-ion laser); for practical devices, materials exhibiting the same properties at solid state source wavelength need to be found. (16 refs.)

71247 Detection techniques for measurement of DC magnetic fields using optical fibre sensors. R.E.Jones, J.P.Willson, G.D.Pitt, R.H.Pratt, K.W.H.Foulds, D.N.Batchelder (Standard Telecommunication Labs. Ltd., Harlow, England).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.33-7
A modified Mach-Zehnder interferometer has been constructed using optical fibres in both sensor and reference arms. Particular emphasis has been placed on developing a system useful for practical field sensing applications. To this end a detector configuration using a photodiode array and microcomputer was used and found to overcome several of the sources of noise and lack of sensitivity in conventional systems. Results have been presented which demonstrate metallic glasses to be suitable magnetostrictive materials for optical fibre magnetometers. Remaining sources of noise have been analysed and suggestions made regarding further improvements to the system. (7 refs.)

71248 A single-mode fibre Michelson interferometer sensor. R.Kashyap, B.K.Nayar (British Telecom Res. Labs., Martlesham Heath, Ipswich, England).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.38-42
The authors have demonstrated for the first time, the use of a single-mode all fibre Michelson interferometer for sensing applications. This interferometer configuration is simpler than the Mach-Zehnder generally used and preliminary results indicate that similar performance can be expected. Remote sensing has also been demonstrated with the sensor operating over a kilometer of optical fibre. Although quadrature locking was demonstrated using two photodiodes, the interferometer can be locked to any point in the interferogram by the use of a single photodiode using the method proposed by Olsson et al. (1980). The use of this configuration with a larger tuning range of a semiconductor laser diode, would be particularly suited to remote sensing applications such as a hydrophone, where it may be desirable not to have any submersible power feed or electronics, allowing signal detection and processing to be carried out at the source end. (10 refs.)

71249 Signal recovery techniques for unbalanced fibre interferometric sensors illuminated by laser diodes. A.D.Kersey, M.Corke, J.D.C.Jones, D.A.Jackson (Univ. of Kent, Canterbury, England).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.43-7
Describes two methods by which the dependence of the emission frequency of GaAlAs lasers on injection current can be used to achieve the recovery of signal phase shifts between the arms of an unbalanced interferometric sensor. These methods fall into the categories of: (i) pseudo heterodyne and (ii) passive homodyne detection. The schemes achieve the recovery of signal phase shifts in an interferometric sensor free of the signal fading which would otherwise affect the output. Minimum detectable signal phase shifts obtained using the detection schemes were found to be close to the fundamental limit set by the frequency jitter (phase noise) of the diode laser used. (9 refs.)

71250 Fiber optic interferometric sensor development at NRL. A.Dandridge, A.B.Tveten, R.O.Miles, T.G.Giallorenzi (Naval Res. Lab., Washington, DC, USA).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.48-52
Briefly discusses some of the aspects of fiber optic interferometric sensor research with special emphasis given to noise sources (and noise reduction), demodulation schemes and packaging. (19 refs.)

71251 Optical fibre sensor markets. A.L.Harmer (Battelle Res. Inst., Geneva, Switzerland).
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.53-6
Attempts to provide an assessment of the f.o. sensor markets taken from the research standpoint. The first part of the paper looks at current world-wide research activities, the major government-funded and private programmes, the types of sensors that are being developed, and the applications foreseen. The second part tries to relate this research effort to needs and potential markets. The importance of rival technologies, such as new developments in semiconductor sensors and smart sensors, must also be considered in determining the future impact of optical fibre sensors in instrumentation. (4 refs.)

First International Conference on Optical Fibre Sensors ....See Entry 69795

The eikonal approximation applied to sizing transparent fibres using the scattered intensity-ratio technique ....See Entry 70030

Sensors and transducers based on optical fibres ....See Entry 70045

Methods of measuring the profile of the refractive index of optical fibres ....See Entry 70106

Fringe benefits: applications of holographic elements ....See Entry 71088

Restoration of single-frequency emission by suppression of pulsations of the intensity of the radiation emitted by an injection laser ....See Entry 71128

Excitation of stimulated Raman scattering in graded-index fiber waveguides by an arbitrary Gaussian beam ....See Entry 71185

Bending property and allowable bending radius for unit-type optical cable ....See Entry 71255

Preparation of germanate glass by vapor-phase axial deposition ....See Entry 71259

Optical fiber thermometer for medical use ....See Entry 73655

42.80Q Image detectors, convertors, and intensifiers

71252 Current electron-optical apparatus based on time-analyzing electron-optical converters. B.Z.Gorbenko, B.M.Stepanov (All-Union Phys. Optics Res. Inst., Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.985-8 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.185-8 (July-Aug. 1982). [received: May 1983]
Deals with Soviet commercial and experimental electron-optical cameras based on time-analyzing electron-optical converters and also with some of the latest models of foreign commercial cameras, which together indicate the state of the art abroad. The cameras are classified in terms of the types of EOC used. Cameras are compared on the sweep times in photochronographic mode; brief technical characteristics are given of the cameras. (no refs.)

71253 Holistic system design maximizes night vision device performance. L.Bjork, L.Owen, J.Wagner, M.Lund, J.Kylander (Litton Industries, Tempe, AZ, USA).
Mil. Electron./Countermeas. (USA), vol.9, no.2, p.34-9 (Feb. 1983).
Considers the factors which influence the performance of a night vision system. The limiting factor in the optimum system design is the light amplifier or image intensifier. A wide range of tubes and devices for night vision systems are necessary to provide optimum and cost-effective second- and third-generation night vision equipment for the military. (no refs.)

71254 Infrared optics for military electronics systems require high-quality optical coatings. M.Speciale, F.Zmarzly (Optical Coating Lab. Inc., Santa Rosa, CA, USA).
Mil. Electron./Countermeas. (USA), vol.9, no.2, p.43-5 (Feb. 1983).
Primary infrared-based electronics systems and how the infrared optics function within each system type are discussed. Optical coatings are an intrinsic aspect of the proper functioning of the optical components of these IR systems. (no refs.)

Picosecond streak camera fluorometry. A review ....See Entry 70117

Image intensifier gain measurements ....See Entry 73921

42.80S Optical communications devices

71255 Bending property and allowable bending radius for unit-type optical cable. Y.Katsuyama, H.Kobayashi, Y.Mitsunaga, K.Harada, Y.Ishida (Ibaraki Electrical Communication Lab., NTT, Ibaraki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part B (Japan), vol.J66B, no.2, p.201-8 (Feb. 1983). In Japanese.
Describes a bending characteristics of unit-type optical cable. Approximate equations for a double spiral have been derived. The equations represent curvature, strain and loss increase of optical fiber in the bent cable. The bending characteristics were evaluated for the optical cables manufactured. The allowable bending radii R have been determined by theoretical and experimental results. The allowable values are $R=200$ mm for static bending and $R=600$ mm for dynamic bending under the conditions that no failure and no loss increase of the fiber occur for 20 years. (11 refs.)

42.82 INTEGRATED OPTICS

(for optical waveguides see also 42.80L)

71256 Integrated optics: strides toward the single chip. L.D.Hutcheson (Honeywell Corporate Technol. Center, Bloomington, MN, USA).
Photonics Spectra (USA), vol.17, no.4, p.47-52 (April 1983).
Reports the progress made in thin-film waveguides and guided-wave lens fabrication. The three guided-wave lenses considered are: (a) geodesic lens; (b) Luneburg lens; (c) Fresnel lens. (9 refs.)

71257 Integrated optical devices using amorphous As_2S_3 thin film. T.Yaji, S.Kurita, Y.Tejima, A.Horinouchi, M.Koyanagi (Dept. of Electrical Engng., Keio Univ., Yokohama, Japan).
IEEE Trans. Components, Hybrids & Manuf. Technol. (USA), vol.CHMT-6, no.1, p.134-5 (March 1983). (28th Annual Holm Conference on Electrical Contacts, Chicago, IL, USA, 13-15 Sept. 1982).
An amorphous As_2S_3/liquid-crystal integrated optical switch is described and fabrication of rib waveguides in amorphous As_2S_3 films is reported. (3 refs.)

71258 Multistructured optical IC elements by polymer thin films. I.Kato, M.Komatsu (School of Sci. & Engng., Waseda Univ., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.2, p.145-8 (Feb. 1983). In Japanese.
Traditionally, thin film optical circuit elements are constructed by arranging optical waveguides side by side or crossing them on one plane. The authors report new type multistructured optical integrated circuit elements constructed by piling up thin film waveguides. A photochemical reaction is used to form waveguides in polymer thin films. As an example of these elements, directional couplers have been made using two and three thin film layers, in which waveguides cross over on two levels and light energy is transferred upward or downward between two waveguides directly and indirectly through a middle layer. The cross angle was increased from 0 to 4° giving the coupling coefficient of 3 to more than 12 dB. (4 refs.)

Optical transistors and bistable devices utilizing nonlinear transmission of light in systems with unidirectional coupled waves ....See Entry 71177

Geodetic and two-layer lenses based on dielectric diffusion lightguides ....See Entry 71215

Thin-film elements of structure containing wedge optical transition ....See Entry 71218

Thin-film optical components of hybrid structure formed of Ta_2O_5 on a diffusion lightguide ....See Entry 71219

Optical polarizers for the ultraviolet ....See Entry 71223

Electro-optical light modulation in InGaAsP/InP double heterostructure diodes ....See Entry 71225

Picosecond pulse response of broad-band guided-wave interferometric light modulators ....See Entry 71227

Wave scattering and guidance by dielectric waveguides with periodic surfaces ....See Entry 71229

Calculation of the phase sensitivity of a thin-film controlled coupler ....See Entry 71232

Fabrication and investigation of thin-film CdS_xSe_{1-x} waveguides ....See Entry 71233

42.85 OPTICAL TESTING AND WORKSHOP TECHNIQUES

71259 Preparation of germanate glass by vapor-phase axial deposition. H.Takahashi, I.Sugimoto (Central Res. Lab., Furukawa Electric Co. Ltd., Shinagawa-ku, Tokyo, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C66-7 (April 1983).
Antimony-doped germanate-glass rods for fabricating optical fibers, which transmit up to $\approx 3\ \mu m$, were prepared by the vapor-phase axial deposition method. (6 refs.)

Device for observing microheterogeneities in interference coatings ....See Entry 70111

A close look at optical plastics. II. Manufacturing and production tolerances ....See Entry 71209

Geodetic and two-layer lenses based on dielectric diffusion lightguides ....See Entry 71215

Optical polarizers for the ultraviolet ....See Entry 71223

Progress in fiber test standards ....See Entry 71236

OTDR puts fibers to the test ....See Entry 71237

Integrated optics: strides toward the single chip ....See Entry 71256

Development of porous antireflective films on borosilicate glasses ....See Entry 73238

43.00 ACOUSTICS

(for audition, see 87.34; for speech, see 87.36; for sound effects on living matter, see 87.50C)

43.20 GENERAL LINEAR ACOUSTICS

(see also 03.40K Mathematical problems in waves and wave propagation)

71260 Scattering of acoustic waves on free surface perturbations in an elastic half-space. F.Witos (Inst. of Phys., Silesian Tech. Univ., Gliwice, Poland).
Arch. Acoust. (Poland), vol.7, no.1, p.43-59 (1982).
Considers a semi-infinite, homogeneous and linearly elastic medium with a perturbed free surface. The perturbation is material loss. Using the Green function method, the first Born approximation is found for the field of displacements dependent harmonically on time. Subsequently the energy relations for the solutions obtained are calculated. The character and magnitude of scattering on the perturbation are thus defined for any mode occurring in a semi-infinite, homogeneous and linearly elastic medium. In addition, the case of perturbations described by periodic functions, which is essential in practice, is analyzed. (13 refs.)

71261 One-dimensional acoustic wave propagation in a particulate suspension. K.Nikaien, J.Peddieson,Jr., B.C.Au (Dept. of Mech. Engng., Tennessee Technol. Univ., Cookeville, TN, USA).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.851-62 (1983).
Both Laplace and Fourier transforms are applied to the problem of one-dimensional acoustic wave propagation in a semi-infinite duct containing a particulate suspension. Both methods lead to closed-form solutions in terms of integrals which must be determined numerically. This is done, the methods are evaluated, and representative numerical results are presented and discussed. (5 refs.)

71262 Surface acoustic admittance of highly porous open-cell, elastic foams. R.F.Lambert (Dept. of Electrical Engng., Univ. of Minnesota, Minneapolis, MN, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1139-46 (April 1983).
This work presents a comprehensive study of the surface acoustic admittance properties of graded sizes of open-cell foams that are highly porous and elastic. The intrinsic admittance as well as properties of samples of finite depth were predicted and then measured for sound at normal incidence over a frequency range extending from about 35-3500 Hz. The agreement between theory and experiment for a range of mean pore size and volume porosity is excellent. The implications of fibrous structure on the admittance of open-cell foams is quite evident from the results. (7 refs.)

71263 Target strength of liquid-filled spheres. D.L.Folds, C.D.Loggins (Naval Coastal Systems Center, Panama City, FL, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1147-51 (April 1983).
The liquid-filled target sphere is a high target strength reflector which, since its first use in 1971, has proven to be of great utility in sonar research. The spherical metal shell filled with alow-velocity liquid is being used as a calibrated, passive, aspect-independent target. To date, the characteristics of this target have only been described in a narrow *ka* range by simple ray theory models. In this paper, a comprehensive treatment for $0<ka<100$ for various shell materials and filling fluid refractive indices is presented, using results from wave theory analyses. Comparisons are made with air-filled and water-filled spheres and with solid spheres. Form function versus *ka* plots, echo time history, and target strength versus frequency are presented. Results show good agreement between computed and measured target strengths and permit an accurate prediction of target strength over a wide range of frequency and fluid velocities. (8 refs.)

71264 Cavity resonances in engine combustion chambers and some applications. R.Hickling, D.A.Feldmaier, F.H.K.Chen, J.S.More (Engng. Mech. Dept., General Motors Res. Labs., Warren, MI, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1170-8 (April 1983).
Cavity resonances in engine cylinders are caused by combustion events such as the rapid rate of pressure rise that occurs during compression ignition in diesels or from knock in gasoline engines. These resonances generally occur at frequencies greater than 4 to 5 kHz where the engine structure is not an efficient acoustical radiator. However, when they occur at lower frequencies such as in engines with a large bore or in indirect injection diesels, they can be important in the noise generation process. They are also important for knock detection in gasoline engines. Current knock detection systems are tuned to the frequency band of the lowest cavity resonance in the combustion chamber. It is shown in the paper that higher order resonances can also be detected by a knock vibration sensor on the surface of the engine. Another use for the cavity resonances is to determine the bulk temperature of the gas in the combustion chamber as a function of crank angle. This technique is demonstrated in the paper for a heavy-duty two-stroke diesel. Also, the results of several fundamental investigations of cavity resonances in engine combustion chambers are reported briefly. Good agreement is obtained between theoretical prediction of the resonant frequencies and experimental observation. The splitting of degenerate modes into two components is discussed. (18 refs.)

71265 Inverse methods in the reconstruction of acoustical impedance profiles. H.Schwetlick (Dept. of Theoretical & Appl. Mech., Cornell Univ., Ithaca, NY, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1179-86 (April 1983).
Three methods for the reconstruction of inhomogeneities in a one-dimensional lossless medium from incident and reflected wave signals are presented in this paper: the method of characteristics, the Gel'fand-Levitan method, and the newly developed method of iterative local regulization. Reconstructed results from numerical experiments are compared with emphasis on inversion in the presence of noise, and on general excitations. An error analysis and a study of computation requirements are also presented. (12 refs.)

71266 Intensity variance of spherical waves in anisotropic media. M.Schulkin (Appl. Phys. Lab., Univ. of Washington, Seattle, WA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1187-91 (April 1983).
The solution to the problem of determining the intensity variance in the forward direction for spherical waves propagating in an anisotropic medium of Gaussian correlation oblate spheroids has not yet been reduced to elementary functions. However, the solution is known for asymptotic limits at zero range and at very long range where the anisotropic terms are separable in both cases. The author shows that anisotropic terms are also separable for the intensity variance of plane waves at the point where the variance depends on the square of the range. A new anisotropic component is found in this way. He also computes the ratio of the intensity variance for plane waves to that of spherical waves at all ranges in a random medium of Gaussian correlation spheres. Applying this ratio to the plane-wave anisotropic solution yields useful estimates for the variance of spherical waves in Gaussian anisotropic media in the region where the variance depends on the square of the range for both small and large anisotropy. (17 refs.)

71267 An alternative approach for formulating the backscattering equation in Sigelmann and Reid's method. K.K.Shung (Bioengng. Program, Pennsylvania State Univ., University Park, PA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1384-6 (April 1983).
The theoretical expression derived by Sigelmann and Reid (1973) for calculating backscattering coefficient from an ensemble of scatterers using a substitution technique can also be obtained directly by considering the intensity of the wave and existing scattering theorems. This approach is much simpler and clearly demonstrates the physical meaning of the experimentally determined backscattering coefficient. (17 refs.)

71268 Modeling and applications of straight-through resonators. P.T.Thawani (Corporate Res. Dept., Nelson Industries Inc., Stoughton, WI, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1387-9 (April 1983).
Straight-through concentric resonators have been modeled by coupling the acoustic wave propagation through the inner perforated pipe and the outer cavity by means of the radial particle velocity through the perforate holes. The decoupled equations of wave propagation are solved using the boundary conditions in the cavity resulting in a two-by-two transfer matrix. In this study the decoupling procedure was used for deriving the transfer matrix for a partially perforated straight-through resonator. This transfer matrix was used for predicting the transmission loss for some typical resonator configurations. Experimental and analytical results of several resonator configurations are presented showing good agreement. (9 refs.)

71269 A finite-difference treatment of interface conditions for the parabolic wave equation: the irregular interface. D.Lee (Naval Underwater Systems Center, New London, CT, USA), S.T.McDaniel.
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1441-7 (May 1983).
A finite-difference solution to the parabolic wave equation is extended to treat an irregular interface. Interface conditions are developed to preserve conti-

nuity of pressure and continuity of the normal component of particle velocity at the boundary between media having different sound speeds and densities. A complete mathematical treatment for the case of an irregular interface is presented. To demonstrate the method, numerical results are obtained for sound propagation from deep to shallow water. (6 refs.)

71270 Acoustic resonance scattering by a penetrable cylinder. D.Brill (US Naval Acad., Annapolis, MD, USA), G.C.Gaunaurd.
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.148-55 (May 1983).
Although sound scattering by submerged elastic cylinders has been the subject of many papers, it was only recently that this and similar problems have been examined in the light of the resonance scattering theory (RST). Crucial experiments have been performed recently at Le Havre, France, in which the modal resonances contained within the cylinder's backscattering cross section were isolated by means of a background subtraction, experimentally accomplished by a clever time-gating technique. In the present paper, the authors generate a variety of tailor-made calculations and graphical displays required to thoroughly examine those experiments in the light of the RST. For the same cylinder, liquids, and frequency ranges of interest they have produced many spectral graphs displaying all the model resonances that combine with the modal backgrounds to produce the observed and/or predicted cross sections. The calculations: (a) display the whispering gallery and Rayleigh-type poles in the complex frequency plane and show their connection with the target resonances they generate, which manifest themselves as circumferential waves around the target, (b) explain quantitatively why some of the modal resonances were missed in the experiment, (c) establish comparisons between predicted and observed monostatic and bistatic form functions (or cross sections) in a direct scattering mode of operation, and (d) show ways to improve both the monostatic and bistatic measurements performed at Le Havre, paving the way toward the solution of inverse scattering situations. Within the limits of simple shapes and compositions, and within the controlled environment of the laboratory, these favorable comparisons have satisfactorily validated many of the predictions of the RST in the field of acoustics. (25 refs.)

71271 Resonance reflection of acoustic waves by a perforated bilaminar rubber coating model. P.D.Jackins, G.C.Gaunaurd (Naval Surface Weapons Center, White Oak, Silver Spring, MD, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1456-63 (May 1983).
Constructs the prediction of the resonance scattering theory (RST) for the reflection of sound waves by a bilaminar rubber configuration separating two dissimilar semi-infinite acoustic media. The layers are further assumed to contain distributions of spherical air-filled perforations, of various concentrations in each layer, whose behavior is governed by a simple, static, 'effective parameter' model. The authors compare the direct scattering prediction of the RST to that of the exact solution in order to show the usefulness of the RST to yield clear physical interpretations of complex phenomena. The casting of the direct scattering solution in 'RST-form' also provides a systematic method to solve the inverse scattering problem for the composition of the bilaminar rubber configuration. The 'response surface' and response curves of the returned echoes are shown to contain certain modulation effects, described in the text, that actually characterize the material composition of each of the layers making up the coating model. The process disentangles which resonance feature present in the reflection coefficient is caused by which one of the interacting layers. In particular, the authors can separate and identify the impedances and the respective thickness-to-speed ratios (transit times) of each of the layers, and if additionally, either the thicknesses or the speeds are known, then, the process determines the other one and also the layer densities all from the resonances in the remotely sensed acoustic reflections. (17 refs.)

71272 Glory- and rainbow-enhanced acoustic backscattering from fluid spheres: models for diffracted axial focusing. P.L.Marston, D.S.Langley (Dept. of Phys., Washington State Univ., Pullman, WA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1464-75 (May 1983).
Transmitted-wave contributions to backscattering from large spheres are calculated. Amplitudes due to glory rays are enhanced, relative to those of axial reflections, because of focusing. The glory pressure amplitudes are proportional to $a(ka)^{1/2}$, where a is the sphere's radius and k is the wavenumber. The model, though similar in form to one for optical scattering from air bubbles [D.S. Langley and P.L. Marston, Phys. Rev. Lett., vol.47, p.913-916 (1981)], contains new features to facilitate the summing of amplitudes in a range of angles. An additional enhancement due to rainbow focusing is modeled for certain sound velocity ratios M; for these M the backscattered amplitude is proportional to $a(ka)^{2/3}$. Major features of the exact scattering are reproduced by these models when $ka=1000$ and (with defects) $ka=100$. The enhancements are not intrinsically due to resonance. Applications to the design of passive sonar targets are noted. (34 refs.)

71273 Low-frequency acoustic diffraction by a soft elliptic disk. A.Roy, F.J.Sabina (Inst. de Investigaciones en Matematicas, Aplicadas y en Sistemas, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1494-8 (May 1983).
The problem of the diffraction of an arbitrary incident plane sound wave by a soft-sound elliptic disk is studied. A Fredholm integral equation of the first class is posed and solved explicitly in the low-frequency limit up to terms of $O(\kappa^2)$, κ being the wavenumber, though higher order terms could be found in a similar fashion without much difficulty. The solution is new and expressions for the farfield amplitude (which are also believed to be new) and the scattering cross section are obtained to the same order. The limiting values when the ellipse degenerates into a circle agree with those of a circular disk found using other methods. Also the scattering cross section agrees with expressions obtained using alternative methods. (8 refs.)

71274 Crosscorrelation functions for directionally distributed energy fields. T.E.Barnard (Defense Electronics Div., Gould Inc., Glen Burnie, MD, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1505-19 (May 1983).
This paper presents the time-lag probability density function between two sensor outputs for several types of directionally distributed energy fields. The convolution of this density function with the inverse Fourier transform of an energy field's frequency power density spectrum is the crosscorrelation function between the two sensor outputs. (32 refs.)

71275 A series expansion of the acoustic power radiated from planar sources. E.G.Williams (Naval Res. Lab., Washington, DC, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1520-4 (May 1983).
A series expansion in ascending powers of the wavenumber k is derived for the acoustic power delivered by baffled or unbaffled planar sources. This series provides a relatively simple means of deriving expressions for the power radiated by a baffled source with a known velocity distribution and can be used for unbaffled plates when the velocity field outside the plate is also known. The terms in the series are calculated from the moments of this velocity distribution in the plane containing the source. If these moments are written as derivatives in wavenumber space, it is shown that a MacLaurin expansion of the Fourier transformed velocity provides an easy technique for computing the first few terms of the acoustic power. Examples are provided for baffled, rectangular plates with various boundary conditions. The arbitrarily shaped plate with free boundaries is particularly interesting. It is proven that the volume flow across its surface must be zero and as a result corner and edge mode radiation cannot exist for this kind of source. (18 refs.)

71276 Effect of the branch-cut on the transformation between modes and rays. Tain Fu Gao (Inst. of Acoustics, Acad. Sinica, Peking, China), Er-Chang Shang.
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1551-5 (May 1983).
In this paper the effect of the branch-cut on the transformation between the modes and rays is discussed. Characteristics of the bottom reflection coefficient on the ζ plane were analyzed in detail and a certain branch-cut was taken. Once the integral path of the generalized ray is deformed to the real axis of the ζ plane, the ray representation consists of 'canonical' generalized ray and a 'lateral term'. The mode representation and the ray representation are given as follows: Mode representation$=\Sigma_n^\infty\phi_n(r,z,z_0)+\oint_b$. Ray representation$=\Sigma_l^\infty B_l(r,z,z_0)+\Sigma_l^\infty\oint_{bl}$. It was found that the 'canonical' generalized ray B_l and the normal mode ϕ_n were still connected by the Poisson summation relation strictly, as proved by the authors' previous paper [Gao and Shang, J. Sound Vib., vol.80, p.105-115 (1982)]. The sum of the 'lateral term' of the 'canonical' generalized ray was exactly equal to the part of the 'lateral' wave in the mode representation: $\oint_b=\Sigma_l^\infty\oint_{bl}$. (5 refs.)

71277 Finite element formulations for acoustical radiation. R.J.Astley, W.Eversman (Univ. of Missouri, Rolla, MO, USA).
J. Sound & Vib. (GB), vol.88, no.1, p.47-64 (8 May 1983).
Finite and infinite element techniques are applied to linear acoustical problems involving infinite anechoic boundaries. Theory is presented for a simple one dimensional model based on Webster's horn equation. Results are then presented both for the one dimensional model and for two axisymmetric test cases. Comparisons with exact solutions indicate that both the infinite element and wave envelope schemes are effective in correctly predicting the near field. The wave envelope scheme is also shown to be capable of resolving the far field radiation pattern. (15 refs.)

71278 Reflection of spherical sound wave from a rigid cylinder of finite length in slightly oblique incidence. M.Ukigai (Chiba Inst. of Technol., Narashino, Japan), Gaoyuan, Y.Miida.
J. Acoust. Soc. Jpn. (Japan), vol.39, no.1, p.30-5 (Jan. 1983). In Japanese.
An analytical technique for calculating the amplitude of reflected sound wave from a cylindrical target of finite length for its slightly oblique incidence is described. This theory is treated on the assumption that a receiver is located separately from a transmitter. The formulas for the reflectivity are derived approximately under certain geometrical restrictions. The reflectivity is termed as the 'directional sound reflectivity of the cylindrical target', which is defined as the ratio of a reflectional sound pressure from a target to a calculated one which is treated due to the theory of geometrical optics. To verify the validity of the approach, some experiments are performed in air at the frequency of 39.80 kHz. Experimental results show good agreement between the calculated and the measured values and this confirms the usefulness of the technique to calculate the reflection of sound waves from a cylindrical target. (11 refs.)

71279 Measurement methods of waveguide systems designed for ultrasonic transmissions. J.Gorczynski, J.Ksiazek, A.Wojnar.
Pr. Inst. Tele- & Radiotech. (Poland), no.92, p.45-8 (1983). In Polish.
Presents measurement methods of waveguide systems used in technological ultrasonic equipment developed at the Ultrasonic Department Tele-and Radio Research Institute. Block diagrams of the measuring systems are given. (4 refs.)

An examination of the composite-roughness scattering model . See Entry 71289

Modeling of long-range acoustic transmissions through cyclonic and anticyclonic eddies .... See Entry 71290

Normal mode identification for impedance boundary conditions .... See Entry 71291

Ray calculations with beam displacement .... See Entry 71292

Ultrasonic signal distortion and its effects on velocity measurements in dispersive constant-group-velocity media .... See Entry 71293

A finite element approach for predicting nozzle admittances ...See Entry 71625

Propagation of transversal surface acoustic waves (SAW) under heavy periodic electrodes in Y-cut quartz .... See Entry 72206

Rays and local modes in a wedge-shaped ocean .... See Entry 73807

43.25 NONLINEAR ACOUSTICS AND MACROSONICS

(see also 43.60 Acoustic signal processing; 43.88 Transduction; devices for generation and production of sound)

71280 Ultrasonic wave propagation in a layered medium under different boundary conditions. A.Pilarski (Inst. of Fundamental Technol. Res., Warsaw, Poland).
Arch. Acoust. (Poland), vol.7, no.1, p.61-70 (1982).
Presents an analysis of the possibility of using the phase velocity measurements of surface or plate waves for the evaluation of the adhesive bond strength, i.e. of the adhesion degree in layered joints. Dispersive curves are determined for phase velocities in layer on base and layer on layer systems with two kinds of boundary conditions, i.e. welded and smooth ones, by numerical solutions of the characteristic equations. The procedure of deriving these equations for any number of layers is given. (13 refs.)

71281 Propagation of sound in highly porous open-cell elastic foams. R.F.Lambert (Dept. of Electrical Engng., Inst. of Technol., Univ. of Minnesota, Minneapolis, MN, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1131-8 (April 1983).
This work presents both theoretical predictions and experimental measurements of attenuation and progressive phase constants of sound in open-cell, highly porous, elastic polyurethane foams. The foams are available commercially in graded pore sizes for which information about the static flow resistance, thermal time constant, volume porosity, dynamic structure factor, and speed of sound is known. The analysis is specialized to highly porous foams which can be efficient sound absorbers at audio frequencies. Negligible effect of internal wave coupling on attenuation and phase shift for the frequency range 16-6000 Hz was predicted and no experimentally significant effects were observed in the bulk samples studied. The agreement between predictions and measurements in bulk materials is excellent. The analysis is applicable to both the regular and compressed elastic open-cell foams. (11 refs.)

71282 Finite amplitude method for the determination of the acoustic nonlinearity parameter B/A. W.N.Cobb (Appl. Mech., Yale Univ., New Haven, CT, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1525-31 (May 1983).
The acoustic nonlinearity parameter B/A is determined using a method based on the finite amplitude distortion of a sine wave emitted by a piston. The growth of the second harmonic component of this wave is measured by a piston receiver which is coaxial with and the same size as the source. In order to determine B/A, the experimental measurements are compared to a theory which incorporates the nonlinearity parameter. The theory developed for this study accounts for the influence of both diffraction and attenuation on the experimental measurements. For this reason, the method is more accurate than previous techniques that employ plane-wave theory for a lossless medium. To test the measurement method, experimental results for B/A in distilled water, ethylene glycol, and glycerol are compared to established values. The agreement between these values suggests that the measurement accuracy is ±4% for common liquids. (21 refs.)

71283 Theoretical investigation of the response of gas-filled micropores and cavitation nuclei to ultrasound. D.L.Miller, W.L.Nyborg (Dept. of Phys., Univ. of Vermont, Burlington, VT, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1537-44 (May 1983).
Theory is discussed for the transverse oscillation of a small circular interface set into a rigid baffle between gas and liquid. The angular resonance frequency is given by $(15\pi T/4\rho a^3)^{1/2}$, in which a is the radius of the interface, T is the interfacial surface tension, and ρ is the density of the liquid. Damping parameters are obtained for the radiation, viscous, and boundary-layer mechanisms of dissipation. This model system is extended for discussion of the pulsation of gas trapped in a pit or cavity in a solid, which may simulate one type of cavitation nucleus, and straight-through cylindrical holes or pores in a solid sheet, which is applicable to the hydrophobic membranes with gas-trapping micropores used in studies of biological effects produced by ultrasound. Fixed and free conditions at the three-phase line at the periphery of an interface are considered. Finally, the partially gas-filled cavity is treated, and also the partially gas-filled pore with two interfaces which have different mass, stiffness, and damping parameters. The results of these theoretical considerations are expected to be of value for quantitatively evaluating that specific form of stable cavitation which involves the direct activation of pre-existing, stable bodies of gas into ultrasonic pulsation, as experimentally observed, for example, by D. Miller, ibid., vol.71, p.471-476 (1982). (30 refs.)

71284 Turbulence effects on acoustic wave propagation over a smooth surface. S.F.Clifford, R.J.Lataitis (NOAA/ERL/Wave Propagation Lab., Boulder, CO, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1545-50 (May 1983).
A rigorous, mathematical treatment describing refractive turbulence effects on the mean-square pressure $\bar{p}^2$ of an isotropic acoustic source radiating above a smooth boundary is presented. The result is energy conserving, is general enough to allow the insertion of an arbitrary refractive-index correlation function, and does not require the ad hoc introduction of arbitrary parameters. This result is compared and contrasted with earlier work by other authors. (12 refs.)

71285 Self-action and stimulated scattering effects of sound beams in absorbing liquids—thermal self-focusing. F.V.Bunkin, K.T.Volyak, G.A.Lyakov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.316-21 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.575-84 (Aug. 1982). [received: May 1983]
The mechanisms of self-action of intense sound in viscous homogeneous liquids are described and estimated theoretically. It is shown that dissipative mechanisms are predominant for a broad class of liquids. These mechanisms involve viscous heating and the excitation of 'acoustic streaming' whose velocity clearly renormalizes the effective temperature. A number is introduced that distinguishes this class (the thermal analog of the acoustic Mach number). The threshold energy values and the spatial scales of the thermal self-focusing of the sound pulses are calculated. The conditions are found under which the self-action process is more rapid than shock wave formation. (23 refs.)

The audio spotlight: an application of nonlinear interaction of sound waves to a new type of loudspeaker design .... See Entry 71328

Acoustical measurement of solid state non-linearity: application to $CsCdF_3$ and $KZnF_3$ .... See Entry 72055

43.28 AEROACOUSTICS AND ATMOSPHERIC SOUND

(see also 92.60 Meteorology)

An examination of the composite-roughness scattering model . See Entry 71289

43.30 UNDERWATER SOUND

(see also 92.10 Physics of the ocean)

71286 Multiple scattering with applications to fish-echo processing. T.K.Stanton (Marine Studies Center, Univ. of Wisconsin, Madison, WI, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1164-9 (April 1983).
A general expression has been derived and evaluated for the backscattered echo energy of an acoustic pulse due to a collection of identical randomly distributed isotropic scatterers. Excess attenuation of the signal due to the extinction cross section of the scatterers as well as second-order scattering have been taken into account. Special attention is focused toward the numerical evaluation of second-order scattering effects. The expression is evaluated for three scattering geometries. It is shown in each geometry that when the absorption cross section of the scatterers is small, second-order scattering can be a factor in the backscattered energy. In this case, second-order scattering at least partially offsets effects due to excess attenuation in the low-to-moderate attenuation region. When applied to fish-echo processing, it was shown that in most cases the results represent an upper bound for the processed signal from a school of fish. The directional characteristics, acoustic frequency of the pulse in relation to the resonance frequency of the swimbladder (if any), and degree of randomness of the spatial distribution of the fish determine the degree to which second-order scattering plays a role in this area. (14 refs.)

71287 Coherent modes and boundary waves in a rough-walled acoustic waveguide. I.Tolstoy.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1192-9 (April 1983).
The theory of Biot scatter was generalized to acoustically rough interfaces between fluids of differing densities and sound velocities by Tolstoy [J. Acoust. Soc. Am. 72, 960-972 (1982)] for the case $kh \leq 1$, k being the wavenumber and h the mean spacing between roughness elements. The present paper applies this approach to a harmonic point acoustic source in a fluid layer of thickness H and sound velocity c_1, with: (1) a rigid floor with hard pebbles and (2) a soft floor of sound velocity $c_2 \geq c_1$ (Pekeris waveguide) with a monolayer of hard pebbles at the interface. For a ratio $H/h = 10^2$ it is shown that: (a) pebbles have a marked influence on the usual coherent acoustic waveguide modes. This effect is best understood in terms of an alteration of the smooth-walled phase shift suffered by sound totally reflected from the bottom. This is particularly obvious for the Pekeris waveguide, for which the net effect on individual modes, for tightly packed spherical pebbles and for typical bottom acoustic parameters, is to increase their excitation amplitudes by factors approaching 2 near the limit of validity of the scatter theory ($kh = 1$). (b) Pebbles may bring about the existence of a subsonic branch of the lowest mode, corresponding to a wall roughness boundary mode carried by the rough boundary. In the hard-bottomed model this branch always exists for $k \geq (\varepsilon H)^{-1/2}$, where ε is a scattering parameter determined by the shape and volume per unit area of the scatterers. When combined with the criterion $kh \leq 1$ this condition yields a definite boundary wave passband. In the case of the Pekeris waveguide the passband is quite restrictive, being very sensitive to the ratio c_2/c_1; the boundary mode exists only for $c_2/c_1 \simeq 1+\delta$, where $\delta \lesssim 0.008$. For the special case $c_2 = c_1$ the boundary wave is strongest and allows for an entirely subsonic mode having no analog in the smooth-walled model. The c_2/c_1 restriction being fairly stringent one must expect the chief practical effect of this kind of bottom roughness to be of the type (a). (19 refs.)

71288 Measurement of fish target strength and associated directivity at high frequencies. P.H.Dahl, O.A.Mathisen (Fisheries Res. Inst., Univ. of Washington, Seattle, WA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1205-11 (April 1983).
A technique for measuring fish target strength and directivity in the yaw (coronal) plane is described. Measurements were made at 420 kHz on 40- to 60-cm-long salmonids, these are expressed through polar plots. Since fish-length-to-wavelength ratios generally were greater than 100, the estimated square root of backscattering cross section, or its equivalent peak envelope voltage, approaches a Rayleigh distribution. This was verified experimentally. Expressions for the expected value of target strength and its variance were derived. (13 refs.)

71289 An examination of the composite-roughness scattering model. S.T.McDaniel, A.D.Gorman (Appl. Res. Lab., Pennsylvania State Univ., State College, PA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1476-86 (May 1983).
A perturbation technique is applied to derive a composite-roughness theory for acoustic scattering from the sea surface. The leading term in the expansion obtained is the well-known result obtainable using ad hoc arguments. Higher order terms are evaluated to assess their contribution to the high-frequency monostatic backscattering strength of the sea. It is concluded that the leading term in the perturbation expansion provides an excellent approximation. (24 refs.)

71290 Modeling of long-range acoustic transmissions through cyclonic and anticyclonic eddies. S.Itzikowitz, M.J.Jacobson, W.L.Siegmann (Rensselaer Polytech. Inst., Troy, NY, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1556-66 (May 1983).
An approximate ray-acoustic model is used to obtain general information and overall results for long-range sound propagation through mesoscale cyclonic and anticyclonic eddies of arbitrary size and strength. Two-dimensional ray approximations are employed, and currents and horizontal sound-speed variations are averaged along approximate paths within an eddy. Eddy-induced per-ray travel-time changes are shown to depend nearly linearly on current strength and piecewise linearly on eddy size. For transmission ranges of about 1000 km, the presence of the eddy may cause per-ray travel time to increase (or decrease) by nearly 200 ms in the cyclonic (or anticyclonic) case. Variations in eddy current strength alone are shown to cause changes of about 100 ms in per-ray travel time. Currents may cause travel-time changes which are as much as those due to sound-speed variations close to eddy edge, and which are as much as 15% of sound-speed effects elsewhere. This suggests that in an acoustic tomography procedure, a corresponding percentage error in predicted sound-speed variations may arise by neglecting currents. In some total-field examples, it is shown that variations in eddy size and strength, and in source and receiver location, can cause an increase of about 5 dB or decrease of over 10 dB in transmission loss, relative to the case when the eddy is absent. Further, it is shown that explicit inclusion of currents alone may cause an increase or decrease of over 10 dB in transmission loss. (21 refs.)

71291 Normal mode identification for impedance boundary conditions. R.A.Koch, P.J.Vidmar, J.B.Lindberg (Appl. Res. Lab., Univ. of Texas, Austin, TX, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1567-70 (May 1983).
A prescription is presented for identifying normal modes calculated using the plane-wave reflection coefficient (impedance condition) to represent bottom interaction. The new prescription reduces to the usual equality between mode number and number of eigenfunction zeros for a fluid layer over a homogeneous fluid bottom. For a more complex bottom composition, the mode number also has a contribution given by the number of times that, as a function of horizontal wavenumber, the reflection coefficient circles the origin in the complex plane. (11 refs.)

71292 Ray calculations with beam displacement. C.T.Tindle (Phys. Dept., Univ. of Auckland, Auckland, New Zealand).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1581-6 (May 1983).
Ray theory with beam displacement is used to calculate the sound field in shallow water as a function of range. Results for the Pekeris model (1948) are compared with normal mode calculations and agreement is good even when the water depth is only a few wavelengths. The inclusion of beam displacement leads to the formation of ray caustics. Caustics are important at all ranges and occur even in isovelocity layers. Eventual failure of the ray method at short ranges and very low frequencies is traced to difficulties with the approximate evaluation of integrals by the method of stationary phase. (10 refs.)

Optical fibre hydrophones with down lead insensitivity ....See Entry 71245

A finite-difference treatment of interface conditions for the parabolic wave equation: the irregular interface ....See Entry 71269

Doubly asymptotic approximations for vibration analysis of submerged structures ....See Entry 71295

Automated digital benchtop calibration system for hydrophone arrays ....See Entry 71319

Geo-acoustic models for propagation modelling in shallow water ....See Entry 73802

Spectral theory of sound propagation in an ocean channel with weakly sloping bottom ....See Entry 73808

Low-frequency propagation in almost fluid sediments: role of gravity and other stresses ....See Entry 73809

Acoustic ocean with a propagation in the poro-elastic bottom ....See Entry 73811

Sonar location system for freely floating buoys .... See Entry 73950

43.35 ULTRASONICS, QUANTUM ACOUSTICS, AND PHYSICAL EFFECTS OF SOUND

(for phonons in crystal lattices, see 63.; for plasma acoustics, see 52.35; for low-temperature acoustics and sound in liquid helium, see 67.; for acoustic properties of liquids, see 62.60; for acoustical properties of solids, see 62.65; for ultrasonic relaxation, see 62.80; for acoustic properties of thin films, see 68.60; for surface waves in solids, see 68.25; for acoustoelectric effects and acoustic wave amplification, see 72.50; for magnetoacoustic effects, oscillations and resonance, see 72.55; for acousto-optical effects and acoustic holography, see 78.20H and 43.63; for sound effects on living matter, see 87.50)

71293 Ultrasonic signal distortion and its effects on velocity measurements in dispersive constant-group-velocity media. P.L.Edwards (Naval Surface Weapons Center, Silver Spring, MD, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1608-15 (May 1983).
Results are presented of calculations made of distortion experienced by ultrasonic pulses in transmission through dispersive constant-group-velocity media, and the effects that it may have on velocity measurements. Three types of pulses were considered: a pulsed sine wave of constant amplitude, a pulsed sine wave with amplitude varying as sine-squared, and a rectangular pulse. It is shown that the individual waves in the pulsed sine waves move with the phase velocity of a continuous wave, and the envelope moves with the group velocity. It was also found that a pulsed sine wave in going a certain distance in a constant-group-velocity medium repeats itself, and midway between these distances if the negative of the values at the repetition distances. Because of this repetition phenomenon it is seen that the pulses propagating through the constant-group-velocity dispersive media do not spread as is normally the case in dispersive media. The envelopes of the propagated waves were also calculated, and in agreement with Brillouin's results [Wave Propagation and Group Velocity (Academic, New York, 1960)] it was found that if the envelope contains negligible frequency components above the carrier frequency, then the envelope is not distorted in passing through a dispersive constant-group-velocity medium. (4 refs.)

Theoretical investigation of the response of gas-filled micropores and cavitation nuclei to ultrasound ....See Entry 71283

43.40 MECHANICAL VIBRATIONS AND SHOCK

(see also 46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves and shocks)

71294 Statistical models in vibration analysis. H.G.Davies, M.A.Wahab, S.I.Khandoker (Dept. of Mech. Engng., Univ. of New Brunswick, Fredericton, New Brunswick, Canada).
Can. Acoust./Acoust. Can. (Canada), vol.11, no.2, p.37-44 (April 1983).
Statistical models are often used in the analysis of vibration levels of complicated dynamic structures, particularly at high frequencies when the high numbers of modes involved in the vibration make both the usual modal analysis and also numerical analysis unfeasible. Results from such models often compare favourably with experimental results. A particular simple coupled-beams structure is considered here. The vibration analysis is carried out within the framework of statistical energy analysis. In particular, results for the power flow from one beam to another are obtained. An ensemble of similar structures is constructed by varying the lengths of the beams. Exact values of the mean and standard deviation of the power flow are calculated for this ensemble. Approximate results from statistical models of the structure, including the statistical energy analysis result, are shown to compare very well with the exact results. (9 refs.)

71295 Doubly asymptotic approximations for vibration analysis of submerged structures. T.L.Geers, C.A.Felippa (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1152-9 (April 1983).
Doubly Asymptotic Approximations (DAAs) are differential equations for boundary-element analysis of the interaction between a complex structure and a surrounding infinite medium. In this paper, the use of first- and second-order DAAs for steady-state vibration analysis of submerged structures is examined. First, the governing discrete-element equations for the general problem are set down and discussed. Then the accuracy of three DAA forms is studied through the generation of numerical results for a submerged spherical shell. Although the first-order DAA is found to be inadequate, the two second-order forms show considerable promise. (23 refs.)

71296 Analysis of low frequency sound radiating from bridge by a travelling vehicle. T.Ohshima (Kitami Inst. of Technol., Kitami, Japan), S.G.Nomachi.
J. Acoust. Soc. Jpn. (Japan), vol.39, no.1, p.11-18 (Jan. 1983). In Japanese.
Test results on an actual bridge due to a moving truck are measured and analysed. The spectrum analyses of the acceleration wave of the bridge vibration and the sound radiating from its surface are done and they are in a good agreement of the peak frequencies to each other. Dynamic response analysis of the bridge forced by a travelling vehicle, is handled by means of the folded plate theory, and lastly the SPL of the low frequency range is formulated from the particle velocity equation corresponding to bridge and moving vehicle system. The envelope curve of the peak of theoretical SPL values may have a good agreement to the experimental ones. In the numerical calculation, the power spectrum density of the sound and the distributions of the sound in the crosswise direction of the bridge, truss bridge and box girder bridge, are obtained. The power spectrum density of the sound obtained by the effective elementary beam theory are compared with the one given by the folded plate theory and they have a good agreement in the low frequency range. (10 refs.)

71297 Measurement of vibration velocity distributions in disks of Pb(zr.Ti)O$_3$ using optical heterodyne technique. S.Sakuma, S.Ueha, E.Mori (Res. Lab. of Precision Machinery & Electronics, Tokyo Inst. of Technol., Yokohama, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.1, p.45-51 (Jan. 1983). In Japanese.
By using an optical heterodyne technique, vertical vibration velocity distributions along the radial direction in disk or bevelled disk transducers of Pb(Zr.Ti)O$_3$ are successfully measured together with their relative vibration phases referring to the applied driving signals. They are essential to calculate their volume velocity or directional patterns. The experiment is carried out changing the diameter to thickness ratio from 2 to 12. Their frequency spectra (frequency range: 1-700 kHz) are also measured to be compared with the vibration velocity distributions. The velocity distribution and frequency spectra show that two groups of radial vibration coupling with the thickness extensional vibration obviously exist in disk vibrations. These two groups are analytically confirmed by finding out the corresponding boundary conditions. The relations among the diameter to thickness ratio, frequency spectra and vibration modes of disk-type piezoelectric ceramic transducers are clarified. (13 refs.)

Comments on 'Sound radiation from building elements' [and reply] ....See Entry 71304

Longitudinal vibrations in violin strings ....See Entry 71317

Identifying vibrations in designing thin-walled structures with elastically attached weights ....See Entry 71348

Action of weak shock waves on a membrane separating two acoustic half-spaces ....See Entry 71458

The low wavenumber wall pressure spectrum on a flexible surface ....See Entry 71540

43.45 STATISTICAL STUDIES OF ACOUSTICAL RESPONSE

(see also 43.55 Architectural acoustics)

71298 Progressive phase trends in multi-degree-of-freedom systems. R.H.Lyon (Dept. of Mech. Engng., MIT, Cambridge, MA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1223-8 (April 1983).
The relative phase of the response of a dynamical system to its excitation has been largely ignored in problems dealing with noise response of such systems. This is because mean-square amplitude functions are able to predict many of the quantities that one is interested in such as crack growth, noise radiation, and clearance impact probabilities without concern for phase. But phase has an essential role in other cases, such as phase coherence of vibration fields, or the design of filters to 'dereverberate' a received signal. This paper describes some early results of the analysis of phase response of multi-degree-of-freedom systems, using ideas that are closely related to statistical energy analysis, until now, used exclusively for the kinds of problems listed above that tend to ignore phase. The present results show good agreement between simple theory and experiments, but more importantly, they suggest directions for further work that should have significant payoff in the future. (3 refs.)

43.50 NOISE, ITS EFFECTS AND CONTROL

(see also 86.70J Environmental science)

71299 Investigations on acoustic mufflers. W.K.Sa'id (School of Control & Systems Engng., Univ. of Technol., Baghada, Iraq), B.C.Nakra, A.Nassir.
J. Acoust. Soc. India, vol.9, no.2, p.68-74 (April 1981). [received: March 1983]
Various types of basic mufflers and their combinations were investigated both experimentally and theoretically to predict their noise attenuation characteristics. The basic muffler types include the simple expansion, resonator, backflow and absorption. Both parallel and series combinations of these mufflers were also investigated. A test rig was made for the purpose of this investigation where a loudspeaker driven by an oscillator was used as the noise source. In general good agreement was found between the theoretical and experimental results. The results showed that the combination type mufflers are potentially good for high noise attenuation in applications like internal combustion engines, etc. (7 refs.)

71300 Noise source identification—acoustic intensity technique. J.J.Kowelewski (Ontario Hydro Res. Div., Toronto, Canada).
Can. Acoust./Acoust. Can. (Canada), vol.11, no.2, p.25-36 (April 1983).
The determination of the sound power of audible noises and their location are usually complicated by room effects, high ambient conditions and frequently the presence of other sources. The two-microphone acoustic intensity approach was found to be a promising technique for analyzing sources of noise where conventional methods are not particularly practical. A procedure is described for measuring directly acoustic intensity levels using a simple 'calibrator' and commercial available dual channel analyzer. (12 refs.)

71301 An analysis of community complaints to noise. G.A.Luz, R.Raspet, P.D.Schomer (US Army Construction Engng. Res. Lab., Champaign, IL, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1229-35 (April 1983).
Noise complaints received Army-wide for a one-year period were analyzed (a) to determine the relationship between the nature of the complaint and the type of noise and (b) to determine the relationship between complaints and the day-night level (DNL). For blast noise, 77% of complaints mentioned vibration or physical damage or both, thus confirming the validity of the C-weighted DNL as a better measure of blast noise than the A-weighted DNL. The relationship between DNL and complaints, however, was a very weak one. Instead, the data confirmed an independent finding of a recent study of Air Force noise complaints—that complaints are generated by unusual rather than typical noise levels. Since a valid measure of community response to noise should be functionally relatable to the noise dose, complaints do not appear to be a good measure of the community response. To deal with the wide variability in the emotional tone of the complaints a psychological model was developed and tested. The implications of this model for how an airport or Army base should deal with complaints are discussed. (20 refs.)

Analysis of low frequency sound radiating from bridge by a travelling vehicle ....See Entry 71296

Assessment of significant acoustic parameters for rating sound insulation of party walls ....See Entry 71303

Growth of forward masking for sinusoidal and noise maskers as a function of signal delay; implications for suppression in noise ....See Entry 71306

Noise sources detection system based on the propagation law of mutual intensity ....See Entry 71323

Time-of-day corrections in measures of aircraft noise exposure ....See Entry 73499

43.55 ARCHITECTURAL ACOUSTICS

71302 Designing audio for video. V.Gizzi.
DB Sound Eng. Mag. (USA), vol.17, no.3, p.44-9 (March 1983).
Describes the design of a sound mixing facility for Editel New York. The shortcomings of the proces of mixing sound for video is discussed. The structural and acoustical design of the audio mix room is also included. (no refs.)

71303 Assessment of significant acoustic parameters for rating sound insulation of party walls. J.-P.Vian (Centre Sci. et Tech. du Batiment, Grenoble, France), W.F.Danner, J.W.Bauer.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1236-43 (April 1983).
To test the adequacy of French regulations for sound isolation in buildings, subjects were asked to rate their annoyance with samples of music filtered by electronic 'insulation curves' representing different party walls. The insulation curves differed in their shape but all provided an A-weighted level difference at 51 dB with a pink noise source, measured over a 1/3-octave bandwidth of 40 Hz-10 kHz. However, the different insulation curves did not provide the same degree of sound isolation with various music samples due to source spectral differences. A statistically significant correlation was observed between annoyance and the A-weighted level difference ratings of the insulation curves when bandlimited pink noise (125 Hz-4 kHz) was used as a source. This correlation was not present when broadband (40 Hz-10 kHz) pink noise was used for the performance rating. Subjects showed a preference for insulation curves with steeper slopes (9 and 12 dB/oct), thus preferring a greater relative attenuation at higher frequencies. Additionally, the presence of coincidence dips was found to have an effect on subject preference that appeared to depend upon both the frequency range at which they occurred and the slope. The bandwidth of the music signals and the intelligibility of speech in the intruding sounds were also found to influence the annoyance ratings. These results indicate that the level difference method for rating sound insulation could better predict occupant response if the above results were accounted for in the procedure. (18 refs.)

71304 Comments on 'Sound radiation from building elements' [and reply]. P.A.A.Laura (Inst. of Appl. Mech., Puerto Belgrano Naval Base, Argentina), Y.Shen, D.J.Oldham.
J. Sound & Vib. (GB), vol.88, no.1, p.143-4 (8 May 1983).
Laura congratulates Shen and Oldham on their work (see ibid., vol.84, p.11, 1981), stating that agreement between predicted and measured radiation patterns would improve considerably if the Mindlin-Timoshenko thick plate equations were used. It may also be important to consider the effect of rotational flexibility coefficients at the plate edges, using polynomial coordinate functions to represent the plate response. In reply, Shen and Oldham accept that Laura has made some valid points, but state that the difficulty is in specifying the parameters. (6 refs.)

43.60 ACOUSTIC SIGNAL PROCESSING

71305 Processing of the acoustic wave image. M.A.Drzewiecka, M.Sztustakowski.
Arch. Acoust. (Poland), vol.7, no.1, p.29-41 (1982).
Presents investigations of a system for processing the image of acoustic waves generated in transparent media. It also gives an analysis of the system and discusses the influence of parameters of spatial filter apertures and of the acoustic field on the quality of representation of the field intensity distribution. (19 refs.)

71306 Growth of forward masking for sinusoidal and noise maskers as a function of signal delay; implications for suppression in noise. B.C.J.Moore, B.R.Glasberg (Dept. of Experimental Psychology, Univ. of Cambridge, Cambridge, England).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1249-59 (April 1983).
The first two experiments were designed to determine whether mutual suppression in broadband noise increases in strength with increasing overall level. In experiment I masking functions (signal threshold versus masker level) were measured in forward masking as a function of the delay time of a 10-ms signal, both for a broadband noise masker (low-pass filtered at 8 kHz) and for sinusoidal maskers at 1, 2, and 4 kHz. In the latter case the signal frequency equaled the masker frequency. For short signal delays the masking functions were steeper for the sinusoidal masker than for the noise masker. At longer delays the slopes for both masker types decreased and the slopes for the two masker types became more nearly equal. In experiment II the authors investigated the effect of gating a low-level noise cue with the sinusoidal masker. At the longer signal delays the masking functions had equal slopes for the broadband noise masker and the sinusoidal masker with cue. At short signal delays the masking functions for sinusoidal maskers may be artificially' steepened, since the subject lacks an effective cue to distinguish the signal from the masker. The equal slopes at longer delays indicate that mutual suppression of the components within a broadband noise does not increase in strength with increasing overall level. In experiment III they attempted to estimate the magnitude of mutual suppression in a broadband noise by comparing masking functions for a broadband noise and for a noise whose bandwidth was 20% of the center frequency. The suppression was estimated to be about 2 dB at 4 kHz and 8 dB at 2 kHz. A simple mathematical expression, suggested by Jesteadt et al. [J. Acoust. Soc. Am. 71, 950-962 (1982)], was found to give an accurate description of the amount of masking produced by the broadband masker as a function of masker level and signal delay. (29 refs.)

71307 Detection performance characteristics for a system with quantizers, OR-ing, and accumulator. A.H.Nuttall (Naval Underwater Systems Center, New London, CT, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1631-42 (May 1983).
The false alarm and detection probabilities of an N-channel system subject to $L+1$ level quantization, OR-ing, and accumulation of M time samples, are evaluated exactly, with no Gaussian assumptions, for arbitrary values of N, L, M, and for a quantizer with arbitrary breakpoint locations. The channel noises are independent but can have arbitrary statistics. The signal occupies one unknown (possibly changing) channel, if present. Two FFTs suffice to sweep out a complete detection probability versus threshold curve. The optimum placement of quantizer breakpoints, for a fixed total number of levels, $L+1$, is a subtle one and shown to depend on N, M, and the desired level of performance; a simple rule-of-thumb is presented which yields near-optimum capability over the useful range of the operating characteristics. (10 refs.)

71308 Optimizing the performance of a quantizer. W.A.Struzinski (Naval Underwater Systems Center, New London, CT, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1643-7 (May 1983).
In a previous paper [W.A. Struzinski, IEEE Trans. Acoust., Speech, Signal Process., vol. ASSP-30 (4), p.668-671 (1982)], a mathematical model was developed to compute the ORing loss for a system composed of quantizers followed by an ORing device and an accumulator. The quantizer investigated was an eight level (3-bit) device spanning from the noise-only mean, m_0 to $m_0+2\sigma$. The subject paper examines different spans for the same 3-bit quantizer to determine the spin that yields the optimal performance. It is determined that the optimal performance is obtained when the quantizer spans the range m_0 to $m_0+3\sigma$. The ORing loss and the input signal-to-noise ratio requirements for the ORing device are computed for this quantizer. Then, these results are compared with those for the quantizer spanning the range m_0 to $m_0+2\sigma$. based on this comparison, it is concluded that the performance difference increases with a decrease in the false alarm probability and the number of samples in the accumulator and with an increase in the number of channels ORed. (3 refs.)

71309 Signal detection and localization using the Fourier series method (FSM) and cross-sensor data. J.H.Wilson (Ocean Acoustics Div., Sci. Applications Inc., McLean, VA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1648-56 (May 1983).
A significant amount of acoustic information that is available in the individual hydrophone or cross-sensor measurements of line array systems may be irrevocably lost in the conventional beamforming (CBF) process. The Fourier series method (FSM) solution is presented for individual hydrophone pairs or cross-sensor measurements and compared to the CBF output for simulated deterministic acoustic fields consisting of signals embedded in directional noise background. By using the acoustic information lost in CBF, potentially significant improvements in the detection and localization of signals by using FSM. For near-broadside design frequency conditions, FSM gives significant peak signal to background noise enhancement over CBF for a 64-element equally space line array. FSM can also resolve two signals in azimuth separated by less than a conventional beamwidth. These array performance improvements result from the accurate estimation of the high order spatial Fourier coefficients of the acoustic field. It is emphasized that FSM requires no a priori assumptions about the unknown acoustic fields required by adaptive beamforming methods and the FSM solution has no mathematical ill conditioning associated with many of the inverse beamforming methods. (41 refs.)

71310 A method for separating progressive and retrogressive spatial sound waves in real time by a correlation method. K.Kuroiwa (Faculty of Engng., Ohita Univ., Ohita, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.1, p.36-44 (Jan. 1983). In Japanese.
Describes a method for separating in real time each of progressive and retrogressive spatial sound waves directly from the reflective sound field by using a correlation method. A spatial sound wave implies a spatially distributed sound pressure oscillation, that is a sound wave group which travels backward and forward between the sound source and the reflector as time elapses. It can be equivalently expressed and measured in the form of a correlation function obtained from the sound source and receiver signals in the case of scanning the receiver position and fixing time delay. In order to realize the real time separation, the simultaneous scanning both of time delay and receiver position is proposed. Each of progressive and retrogressive spatial sound waves is extracted by scanning time delay with positive and negative time delay ratio respectively, together with scanning receiver positive and negative time delay ratio respectively, together with scanning receiver position with constant moving velocity. Their travelling distances are proportional to the initial time delay. Some exeriments based on the theory are carried out. Then, considering the sound waves' travelling distance and direction, and their attenuation by distance and wavelength, it is shown that the theory and procedure of the method for separating is valid. (12 refs.)

Crosscorrelation functions for directionally distributed energy fields ....See Entry 71274

Ultrasonic signal distortion and its effects on velocity measurements in dispersive constant-group-velocity media ....See Entry 71293

43.70 SPEECH COMMUNICATION

(inc. speech perception, speech intelligibility, and speech synthesis; see also 87.36 Speech)

71311 Laryngeal vibrations: a comparison between high-speed filming and glottographic techniques. T.Baer, A.Lofqvist, N.S.McGarr (Haskins Labs., New Haven, CT, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1304-8 (April 1983).
This study was designed to compare information on laryngeal vibrations obtained by high-speed filming, photoglottography (PGG), and electroglottography (EGG). Simultaneous glottographic signals and high-speed films were obtained from two subjects producing steady phonation. Measurements of glottal width were made at three points along the glottis in the anterior-posterior dimension and aligned with the other records. Results indicate that PGG and film measurements give essentially the same information for peak glottal opening and glottal closure. The EGG signal appears to reliably indicate vocal-fold contact. Together, PGG and EGG may provide much of the information obtained from high-speed filming as well as potentially detect horizontal phase differences during opening and closing. (18 refs.)

71312 Reiterant speech: an acoustic and perceptual validation. L.S.Larkey (Res. Lab. of Electronics, MIT, Cambridge, MA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1337-45 (April 1983).
Reiterant speech, or nonsense syllable mimicry, has been proposed as a way to study prosody, particularly syllable and word durations, unconfounded by segmental influences. Researchers have shown that segmental influences on durations can be neutralized in reiterant speech. If it is to be a useful tool in the study of prosody, it must also be shown that reiterant speech preserves the suprasegmental duration and intonation differences relevant to perception. In the present study, syllable durations for nonreiterant and reiterant ambiguous sentences were measured to seek evidence of the duration differences which can enable listeners to resolve surface structure ambiguities in nonreiterant speech. These duration patterns were found in both nonreiterant and reiterant speech. A perceptual study tested listeners' perception of these ambiguous sentences as spoken by four 'good' speakers—speakers who neutralized intrinsic duration differences and whose sentences were independently rated by skilled listeners as good imitations of normal speech. The listeners were able to choose the correct interpretation when the ambiguous sentences were in reiterant form as well as they did when the sentences were spoken normally. These resutls support the notion that reiterant speech is like nonreiterant speech in aspects which are important in the study of prosody. (22 refs.)

71313 Place cues for nasal consonants with special reference to Catalan. D.Recasens (Dept. of Linguistics, Univ. of Connecticut, Storrs, CT, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1346-53 (April 1983).
This study investigates the perceptual contributions of formant transitions and nasal murmurs to the identification of the unreleased Catalan nasal consonants [n], $[n_p]$, and $[n_v]$ (alveolar, palatal, velar, respectively) after [a] in absolute final position. Transition and murmur patterns were synthesized and varied simultaneously and systematically by interpolating between optimal values obtained from spectrographic analysis of natural speech. Catalan subjects were asked to identify the synthetic stimuli as [n], $[n_p]$, and $[n_v]$. The main findings were: (1) Although transitions provided more effective cues for place for articulation than murmurs, the murmurs did not make a significant contribution to the $[n_v]$-[n] distinction. (2) The cue value of the transitions ($[n_v]>[n]$, [n]) was inversely related to that of the murmurs ($[n_v]$, $[n]>[n_p]$). It is concluded that static and dynamic place cues for nasals in an [aC sharp] context are perceptually integrated with reference to the typical pattern of production of these consonants. (33 refs.)

71314 Statistical audio signal parameters and their significance for speech and music recognition. K.Schulze (Hochschule der Bundeswehr, Hamburg, Germany).
NTG-Fachber. (Germany), vol.83, p.263-72 (1983). In German. (Horrundfunk 6 (Sound Broadcasting), Mannheim, Germany, 23-25 Nov. 1982).
Weibull distribution which can serve for music and speech modelling is explained. The music-speech switch of Belger and Jakubowski, based on the evaluation of exponential decay of sound signal, should be supported by amplitude statistics. Components of sound and simulated signals are discussed, and the conclusion is that Weibull parameter α is a criterion for the speech-music recognition. (13 refs.) *J.M.S.*

Relationships between vocal intensity and noninvasively obtained aerodynamic parameters in normal subjects .... See Entry 73604

Enlargement of the supraglottal cavity and its relation to stop consonant voicing .... See Entry 73605

Computerized measurement of tongue dorsum movements with pulsed-echo ultrasound .... See Entry 73698

43.75 MUSIC AND MUSICAL INSTRUMENTS

71315 Tolerance of intonation deviation in melodic intervals in listeners of different musical training. J.Fyk (Pedagogical Univ., Krakow, Poland).
Arch. Acoust. (Poland), vol.7, no.1, p.13-27 (1982).
The aim of the present experimental paper was to investigate the tolerance of intonation deviations in musical intervals, depending on listeners' musical training. The investigations covered the perception of intonation deviations of chosen melodic intervals in isolation and in melodic context. Tests were edited from music material recorded on magnetic tape and were exposed by a loudspeaker to groups of 8-12 persons. The results obtained confirmed a dominating effect of musical training on the tolerance of intonation deviations in isolated intervals and those in melodic context. It was found out that in a musically trained group the tolerance of intonation deviations in intervals in melodic context was influenced by functional tendency and by the direction of intervals in a musically untrained group. (27 refs.)

71316 Electronic organ: IC sounds. I. H.Hintz, H.Struwe.
Funkschau (Germany), no.8, p.89-92 (15 April 1983). In German.
After an introduction to the fundamentals of an electronic organ, the DIY design of a single-manual instrument is described in detail, supported by circuit diagrams of the master oscillator of 4.331 MHz, the vibrato generator of 6 Hz, the sustain network, the volume and balance controls, and a typical active filter. Complete circuit diagrams of the organ and of the special IC type TDA 1008 containing the 5-octave frequency divider are given. (no refs.) *A.L.*

71317 Longitudinal vibrations in violin strings. A.R.Lee, M.P.Rafferty (Phys. Dept., Univ. Coll., Cardiff, Wales).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1361-5 (April 1983).
The authors report the observation of longitudinal vibrations in violin strings excited by bowing. These vibrations are detected from the rocking motion of the top of the bridge in the direction longitudinal to the strings, with the aid of a photoelectric device. The frequencies of these waves are approximately three octaves above the respective fundamental frequencies of the transverse string vibrations, in line with expectation. It is found that stable oscillations are difficult to sustain in which both the transverse and longitudinal motions can coexist in comparable strength. Essentially pure longitudinal oscillations can be excited by bowing at a forward angle. These modes are difficult to identify in the normal bowing spectrum, and are substantially absent in pizzicato tones, except in the initial transients. (6 refs.)

Chladni figures on a tympani head .... See Entry 69843

A history of violin research .... See Entry 69849

Statistical audio signal parameters and their significance for speech and music recognition .... See Entry 71314

43.85 ACOUSTICAL MEASUREMENTS AND INSTRUMENTATION

(for acoustic noise measurement, see also 43.50; for photoacoustic spectroscopy, see 07.65)

71318 High resolution acoustic microscopy in superfluid helium. J.S.Foster, D.Rugar (Edward J. Ginzton Lab., Stanford Univ., Stanford, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.869-71 (15 May 1983).
An acoustic microscope has been developed which utilizes liquid helium at temperatures less than 0.2K as the coupling medium. At the operating frequency of 4.2 GHz, the acoustic attenuation of the helium is negligible and the acoustic wavelength is 570 Å. Micrographs of a silicon integrated circuit are presented which demonstrate the good signal-to-noise ratio of the imaging and resolution better than 500 Å. (10 refs.)

71319 Automated digital benchtop calibration system for hydrophone arrays. L.Dwight Luker, J.F.Zalesak, C.K.Brown, R.E.Scott,Jr. (Underwater Sound Reference Detachment, Naval Res. Lab., Orlando, FL, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1212-16 (April 1983).
A calibration system is described which can measure the complex sensitivity and directivity patterns of hydrophone arrays, such as sonobuoy arrays, in which the hydrophone elements are individually accessible. These arrays are often deployed over a great distance in the ocean. Calibrating them under free-field conditions would be an extremely difficult task. The system described here allows for their calibration on a benchtop. The entire calibration system is controlled by a computer and requires minimal operator intervention. The computer algorithm is also applicable to hydrophone arrays which do not have individually accessible elements. Results are presented which compare measured directivity patterns with theoretical directivity patterns calculated from the measured complex sensitivities of the individual array elements. (5 refs.)

71320 Improved resonance technique for materials characterization. W.M.Madigosky, G.F.Lee (Naval Surface Weapons Center, White Oak, Silver Spring, MD, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1374-7 (April 1983).
An improved resonance apparatus for materials characterization is described. The apparatus accurately determines the propagation constants of an extensional acoustic wave by exciting a bar of material at one end with a noise source, while the other end is allowed to move freely. Miniature accelerometers measure the acceleration at two locations and their output signals are analyzed by a dual channel FFT spectrum analyzer. At certain frequencies, the acceleration ratio goes through resonant peaks whose amplitudes and frequencies are related to the Young's moduli and loss factors of the material. The apparatus is capable of measuring the acceleration ratio over a frequency range of 25 Hz to 20 kHz. As illustrations of the technique, Young's modulus and loss factor were determined on a viscoelastic material; polyurethane (over a temperature range −13.4° to 81°C) and on two metal matrix composite materials: a silicon carbide-aluminum and a graphite-aluminum. The apparatus was found to be a fast and reliable method to determine dynamic constants. (9 refs.)

71321 An ultrasonic bridge for the study of viscoelastic properties of thin interface films. S.I.Rokhlin (Dept. of Materials Engng., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1619-23 (May 1983).
The method of elastic interface waves which is currently under development has proven effective in the investigation of viscoelastic properties of interfaces in solid bodies. The present paper is concerned with the development of a modified method of measurement, employing ultrasonic interface waves, which makes it possible to investigate the thermomechanical properties of thin interface layers. The effect of temperature variations in the substrates and transducers is eliminated by using a differential acoustic system. Comb transducers are used for excitation and reception of ultrasonic waves. (8 refs.)

71322 A method for displaying the vector of the sound pressure complex reflection coefficient in real time by a correlation method. K.Kuroiwa (Faculty of Engng., Ohita Univ., Ohita, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.1, p.19-29 (Jan. 1983). In Japanese.
Describes a method for displaying the sound pressure complex reflection coefficient Γ of an acoustic panel as a vector directly on a cathode-ray tube in real time by using a correlation technique, and its application to a direct view type measurement of the acoustic properties such as sound absorption coefficient α, acoustic resistance R, acoustic reactance X, and absolute value $|\Gamma|$ and phase ϕ of Γ. In this method, a cross correlation function between source and receiver signals through a narrow band-pass filter which becomes equivalently a sinusoidal sound wave of time delay is used. A vector of Γ is displayed in real time by extracting the real part $|\Gamma|\cos\Phi$ and the imaginary part $|\Gamma|\sin\phi$ of Γ directly from the compound sound wave close to the acoustic panel measured by a correlator using a M-sequence signal and by feeding these two analog values to the vertical and horizontal terminals of the cathode-ray tube. Therefore, it is possible to read each of the acoustic properties (complex reflection coefficient chart, sound absorption coefficient chart, sound absorption coefficient chart and Smith chart) from the vector. Experiments in the case of the normal incidence are carried out. Comparing with the standing wave method, the validity of this method is shown. (12 refs.)

71323 Noise sources detection system based on the propagation law of mutual intensity. K.Arai, S.Araki, T.Shiogai, K.Hayashi (Kanazawa Univ., Kanazawa, Japan).
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.131-8 (Nov. 1982). In Japanese.
An imaging system for mechanical noise sources, based on the propagation law of mutual intensity, was constructed. In order to control the system and reconstruct images, a microcomputer was used. To record the mutual intensity in low degree of temporal coherency, the correlator consisted of two multipliers, two integrators, and a $\pi/2$ phase shifter was introduced. The intensity distribution of an actual noise source was reconstructed at several frequencies, including the case of low power spectrum intensity in addition to the peak power frequency. This system allowed the authors to investigate the spatial distribution of noise sources and its frequency dependence. (6 refs.)

71324 The acoustic microscope. J.Attal (Centre of Electronic Studies of Solids, Montpellier, France).
Recherche (France), vol.14, no.144, p.664-7 (May 1983). In French.
Whilst thoughts have for a long time been directed to the use of sound waves for examining materials it was not until the 1960s that this was first achieved. There are now several examples. The paper describes the place of the acoustic microscope in science, and its capabilities. The general principles of operation of these instruments are given, including the conversion of high frequency sound waves to electrical signals using a small zinc oxide piezoelectric crystal. Some typical photographs are given, together with one of a typical acoustic microscope, and there is a diagram of the sound conversion system. Uses for examining micro-components are described and a description follows of the uses of these instruments for microscopic work. (6 refs.) *G.V.D.*

71325 New methods of determination of emitted acoustic energy. II. Determination of the sound power from measurement of the sound intensity; phase-gradient method. I.Veit (Fraunhofer- Inst. fur Bauphys., Stuttgart, Germany).
Tech. Mess. tm (Germany), vol.50, no.4, p.151-4 (April 1983). In German.
For pt.I see ibid., no.3, p.87-92 (1983). The method of determination of acoustic energy is based on the evaluation of the acoustic intensity; a method based on the relationship of the acoustic intensity and the spectral densities of two sound pressures, which could be measured by means of two microphones placed close to each other is first described. An alternative method of determining the acoustic intensity by measuring the phase gradients of sound pressures in the sound field using only a single microphone is then presented. The two methods are described and discussed in detail and layouts of the suggested equipment are given. A comparison of the two methods is made and their relative merits are pointed out. (34 refs.) *G.R.S.*

Photoacoustic spectroscopy in crystalline semiconductors .... See Entry 70115

Theory of photoacoustic spectroscopy in solids—gas-microphone method .... See Entry 70116

Improvement of ultrasound testing by the installation of electronically controlled test equipment (phased arrays) .... See Entry 70692

Sensitivity vs. size of fibre-optic interferometric sensors .... See Entry 71244

Optical fibre hydrophones with down lead insensitivity .... See Entry 71245

Interferometric sensor using phase conjugate mirrors .... See Entry 71246

A single-mode fibre Michelson interferometer sensor .... See Entry 71248

Ultrasonic signal distortion and its effects on velocity measurements in dispersive constant-group-velocity media .... See Entry 71293

Noise source identification—acoustic intensity technique .... See Entry 71300

Method of fastening piezoelectric element by 'cold soldering' .. See Entry 71326

Photoacoustic and absorption spectra of UF_4 .... See Entry 72811

Inspection of underwater structures by flooded member detection .... See Entry 73288

Echo-response of crack-like reflectors in focused ultra-sound-fields. I .... See Entry 73298

Theoretical framework for spectrum analysis in ultrasonic tissue characterization .... See Entry 73648

43.88 TRANSDUCTION; DEVICES FOR THE GENERATION AND REPRODUCTION OF SOUND

71326 Method of fastening piezoelectric element by 'cold soldering'. Yu.I.Kuzovkov, V.Ya.Nagin (Kiev State Univ., Kiev, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.1035-6 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.230-1 (July-Aug. 1982). [received: May 1983]
A galvanoplastic method is described for fastening resonant acoustic disk transducers for the range 10^2-10^5 kHz. The method has been developed in connection with the construction of a cell for studying the velocity of propagation and the absorption coefficient of ultrasound in dielectric liquids in the frequency range 1-100 MHz at a pressure of up to 100 MPa. It is based on the technology of 'cold soldering' of copper, used in galvanoplasty. (2 refs.)

71327 Variational analysis of a model for a piezoelectric polymer flexural plate hydrophone. P.A.A.Laura (Inst. of Appl. Mech., Puerto Belgrano Naval Base, Argentina), D.Avalos.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1378-83 (April 1983).
An approximate solution for the mathematical model of the piezoelectric polymer flexural plate hydrophone is presented. The case where sheets of polymer are attached to air-backed rectangular flexural plates is treated. This study constitutes an extension of Ricketts' recent treatment (1981) in the sense that (a) dynamic effects are now taken into account and (b) simply supported, clamped, or elastically restrained edges are now considered. (4 refs.)

71328 The audio spotlight: an application of nonlinear interaction of sound waves to a new type of loudspeaker design. M.Yoneyama, J.-I.Fujimoto (Application Products Dept., Ricoh Co. Ltd., Tokyo, Japan), Y.Kawamo, S.Sasabe.
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1532-6 (May 1983).
This work was done to devise a new type of loudspeaker. The theory for sound reproduction of this loudspeaker is based on nonlinear acoustics of sound wave interaction in air. A finite amplitude ultrasound wave that can be amplitude modulated by any audio signal is radiated from a transducer array into air as the primary wave. As a result, an audio signal is produced in the air because of the self-demodulation effect of the AM sound wave due to the nonlinearity of the air. It is possible to get a flat characteristic of reproduced sound pressure by using an equalizer. In some fundamental experiments the characteristic of the reproduced sound pressure is not quite flat due to an imperfect transducer array. Improvement of the transducer makes it possible to get a flat characteristic. A special feature of this loudspeaker is its very sharp directivity pattern, which makes it possible to realize a sound spotlight. (6 refs.)

71329 Ultrasound probes. A.Fukumoto, T.Yano, M.Kawabuchi (Matsushita Res. Inst. Tokyo Inc., Tokyo, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.176-87 (Feb. 1983). In Japanese.
Technologies of ultrasound probes for non-invasive testing instruments are summarized. Basic constructions and functions of ultrasound probes are described from the stand point that the probes are 'electrical' as well as 'acoustical and vibrational' components. Design methods of ultrasound probes are described starting from transducer elements, arrays and electronic circuits connected to the probes. Probe materials developed by the authors are then described. These materials include piezoelectric ceramics, acoustical matching materials and electronic switches used for element selection. Finally, examples of ultrasound probes developed by the authors are described. They are linear, sector, trapezoidal and two-dimensional scanning ultrasound probes for diagnostic ultrasound instruments. Also, as a unique example of the application of ultrasound probe technologies, a delay line transducer used for sector scanning diagnostic ultrasound instruments is explained. (34 refs.)

Pyrene quenching in a fluorescence, photoacoustic, and two-photon photoionization cell .... See Entry 70964

Measurement of vibration velocity distributions in disks of $Pb(zr.Ti)O_3$ using optical heterodyne technique .... See Entry 71297

44.00 HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES

Heat transfer in the last decade .... See Entry 69848

44.10 HEAT CONDUCTION (MODELS, PHENOMENOLOGICAL DESCRIPTION)

71330 Reduced numerical integration in thermal transient finite element analysis. D.R.J.Owen (Dept. of Civil Engng., Univ. of Wales, Swansea, Wales), F.Damjanic.
Comput. & Struct. (GB), vol.17, no.2, p.261-76 (1983).
The stability and accuracy of the so-called 'α-family', two level time integration algorithms for thermal transient problems are considered. In particular, the influence on the solution characteristics of the order of numerical integration rule employed in the evaluation of the element matrices is examined. Consideration is restricted to the four node bilinear and eight node biquadratic isoparametric elements. (18 refs.)

71331 Heat propagation on a shaft due to transient torsional vibration. S.Panteliou (School of Engng., Univ. of Patras, Patras, Greece), A.D.Dimarogonas.
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.111-22 (March-April 1983).
During transient torsional vibration of rotating shafts, heat is generated due to material damping, which results in substantial temperatures. The problem of a cylinder of infinite length heated by way of a transient torsional vibration of variable amplitude is investigated and an expression of the maximum surface temperature is obtained. Diagrams with the appropriate dimensionless parameters are presented together with a numerical example. It is shown that substantial temperatures can be developed as a result of this mechanism of heat generation. This quantifies the belief that this phenomenon was the reason for a major generator failure in a power system. (13 refs.)

71332 Heat conductivity in a spherical heat-emitter with an arbitrarily-varying heat transfer coefficient. G.I.Bogomolov.
Izv. VUZ Mashinostr. (USSR), no.3, p.55-8 (1983). In Russian.
Discusses the steady-state heat conductivity in a spherical heat-emitting element with a single cover, under conditions of unchanging law of the heat transfer coefficient from the element to a heat conductor. This law is expressed by a trigonometric cosine polynomial. The temperature distributions in the cover and in the core are described by a series of Legendre polynomials, with the coefficients meeting the requirements of the Laplace equation in the cover and the Poisson equation in the core, for the corresponding boundary conditions. (3 refs.) *Z.F.V.*

An analysis of coupled thermal-elastic contact problems with the finite element method .... See Entry 71489

A thermodynamic development of generalized Fourier and Ohm conduction laws for anisotropic materials .... See Entry 72365

44.25 CONVECTIVE AND CONSTRAINED HEAT TRANSFER

(see also 47.25Q Convection and heat transfer)

71333 Finite difference calculations of buoyant convection in an enclosure. I. The basic algorithm. H.R.Baum (Center for Fire Res., NBS, Washington, DC, USA), R.G.Rehm, P.D.Barnett, D.M.Corley.
SIAM J. Sci. & Stat. Comput. (USA), vol.4, no.1, p.117-35 (March 1983).
A novel mathematical model of buoyant convection in an enclosure (see R.G. Rehm and H.R. Baum, NBS J. Res., vol.83, p.297-308, 1978) is solved by finite difference techniques in the two-dimensional case. This model has been developed as a principal analytical tool for the prediction of the movement of smoke and hot gases in fires. Effects of large density variations caused by substantial heating are retained while acoustic (high-frequency) waves, which are unimportant to buoyant convection, are analytically filtered out. No viscous or thermal conduction effects are included in the model. The computational procedure uses a software package for solving a nonseparable elliptic equation developed especially for this problem. The computer model has been used to compute the buoyant convection produced in an enclosure by a spatially distributed heat source simulating a fire. (22 refs.)

Thermal stresses in partially absorbing flat plate due to sudden interruption of steady-state asymmetric radiation. I. Convective cooling at rear surface .... See Entry 71381

Thermal stresses in partially absorbing flat plate due to sudden interruption of steady-state asymmetric radiation. II. Convective cooling at front surface .... See Entry 71382

Natural convection produced by unsteady heating of a viscoplastic liquid in a plane vertical layer .... See Entry 71549

Comments on paper [simple multiple wick solar still: analysis and performance] .... See Entry 73419

A two-pass solar air heater .... See Entry 73471

44.30 HEAT TRANSFER IN INHOMOGENEOUS MEDIA AND THROUGH INTERFACES

71334 Solution of synthesis problems for heat-exchange systems. I.I.Golovach.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.3, p.64-7 (1983). In Ukrainian.
A mathematical model of heat-exchange systems (HES) is constructed on the basis of which the problem of HES synthesis is reduced to a discrete problem of optimum control. A method for the solution of this problem is developed. (3 refs.)

71335 Determination of the temperature field in a granular layer. V.I.Kushch, O.G.Artemenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.3, p.74-7 (1983). In Ukrainian.
An exact solution is given for the problem of heat flow passing through a layer containing spherical grains with centres in several parallel planes. In each plane the grain centres form an orthogonal lattice. The temperature values on the lower surface and the effective thermal conductivity are calculated; two diagrams are presented. (2 refs.)

71336 Heat exchange in gas furnaces. S.P.Detkov (All-Union Res. Project & Design Inst. of Metall. Heat Engng., Nonferrous Metall. & Refractories, Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.883-7 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.244-9 (Aug. 1982). [received: April 1983]
Presents a new method of calculating heat exchange on the heating surfaces in furnaces with a real medium but without scatter, with multiple reflections making a considerable contribution to the heat flow. (4 refs.)

71337 Application of the Ritz method in interrelated heat- and mass transfer problem solving. Yu.T.Glazunov.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.96-103 (1983). In Russian.
The possibility of application of the Ritz method is presented in interrelated heat- and mass transfer problem solving under Type I boundary conditions. Thermophysical environmental parameters are considered to depend on transfer potentials. Variational solutions offer considerable precision and good convergence. (4 refs.)

71338 Determining the temperatures in multilayer refractory walls on an analog computer. G.A.Ketslakh (Eastern Coal Chem. Sci.-Res. Inst., USSR).
Refractories (USA), vol.23, no.7-8, p.347-50 (July-Aug. 1982). Translation of: *Ogneupory (USSR)*, vol.23, no.7, p.21-3 (July 1982). [received: April 1983]
The use of the analog computer provides a marked gain in time in comparison with manual calculation in cases in which many variations of walls with different thicknesses of layers of the same materials are calculated. Additional calculation of the functions ϕ and rearrangement of the functional blocks are not required. The solution amounts to a change in certain coefficients and selection of the input voltages. In calculating 30 variations of a three-layer wall the test operator spends no more than 1 h, which provides an approximate 10 times saving in time in comparison with manual calculation by the method of successive approximations. (3 refs.)

71339 Enhancement of radiation cooling by means of reflectors. M.S.Marreiros (Inst. Superior de Engenharia de Lisboa, Lisboa, Portugal), R.Rosa.
Sol. Energy (USA), vol.30, no.5, p.463-71 (1983).
It is shown that radiation cooling to a clear sky can be substantially enhanced by coupling a reflector to the radiator. The class of reflectors considered in this study is the CPC truncated on the side of the exist aperture. It is estimated that, under real circumstances, the cooling power per unit area of entrance aperture can be nearly doubled, with the help of a truncated CPC trough reflector, and the equilibrium limit temperature can be brought some 24°C further down. A truncated CPC dish reflector can still improve on the equilibrium temperature but at the cost of some loss of cooling power. The device can still operate satisfactorily in the day time. (5 refs.)

Geometric configuration factors for polygonal zones using Nusselt's unit sphere .... See Entry 71343

Thermal conductivity of colloidal capillary porous bodies in the process of structure formation .... See Entry 71344

An analysis of coupled thermal-elastic contact problems with the finite element method .... See Entry 71489

Instability of horizontal fluid interface in a perpendicular electric field: observational study .... See Entry 71658

A two-pass solar air heater .... See Entry 73471

Empirical equations for calculation of CPC collector loss coefficients .... See Entry 73474

Comments on 'Critical thickness of a square section' .... See Entry 73475

Thermal model of a cylindrically symmetric solar pond .... See Entry 73477

44.40 RADIATIVE HEAT TRANSFER

71340 A comparison on the stability of horizontal fluid layers with radiative heat generation for two and three porous plates. M.A.Hassab (Dept. of Mech. Engng., Alexandria Univ., Alexandria, Egypt).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.163-70 (March-April 1983).
This note is an extension to a recent work reported by Hassab (1982) on the effect of suction on the thermal stability of a horizontal-fluid layer with non-uniform volumetric heat sources. The heat generation was by way of absorption of incident radiation penetrating the fluid body, which was contained between two porous plates. The purpose of the present work is to extend the analysis for the case in which the fluid layer is divided into two sublayers, by inserting a third transparent porous plate inside it, and to compare the results for the two cases. This work may be applicable to solar heating systems. (2 refs.)

71341 Comparison of radiative transfer approximations for a highly forward scattering planar medium. M.P.Menguc, R.Viskanta (Heat Transfer Lab., Purdue Univ., West Lafayette, IN, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.381-94 (May 1983).
The authors examine critically the accuracy of the two-flux, spherical harmonics and discrete ordinates methods for predicting radiative transfer in a planar, highly-forward scattering and absorbing medium. Numerical results for the radiative fluxes show that the two-flux and P_3-approximations yield accurate results compared to solutions based on the F_N-method. Indeed, these approximate methods are relatively simple and have potential for generalization to predict radiative transfer in multidimensional systems, as long as an appropriate simplification of the phase function is utilized. (41 refs.)

71342 Normalized spectral-distribution function of black body radiation. T.Ishikawa (Illuminating Engng. Inst. of Japan, Tokyo, Japan).
J. Illum. Eng. Inst. Jpn. (Japan), vol.67, no.1, p.13-14 (Jan. 1983). In Japanese.
Plank's law of radiation shows that the emissive power $M_{e\lambda}$ from a perfect radiator (black body) is a strong function of both wavelength λ and absolute temperature T(K). The ratio $f(\lambda T)=M_{e\lambda}(\lambda,T)/M_{e\lambda}(\lambda_m,T)$, where λ_m is the wavelength for maximum emissive power for the temperature T, is called the normalized spectral-distribution function. The total amount of radiation emitted at a particular temperature can be obtained by integrating Plank's law over all wavelength: viz. $\int_0^\infty M_{e\lambda}(\lambda,T)d\lambda$. The ratio $F(\lambda kT)=\int_0^\lambda M_{e\lambda}(\lambda,T)d\lambda/\int_0^\infty M_{e\lambda}(\lambda, T)d\lambda$ is called the normalized cumulative spectral-distribution function. These functions are often convenient for applications compared with Plank's law. (3 refs.) *K.B.*

71343 Geometric configuration factors for polygonal zones using Nusselt's unit sphere. F.W.Lipps (Energy Lab., Univ. of Houston, Houston, TX, USA).
Sol. Energy (USA), vol.30, no.5, p.413-19 (1983).
The Energy Laboratory of the University of Houston has developed a computer simulation program called CREAM (Cavity Radiation Exchange Analysis Model) for application to the solar central receiver system CREAM contains a geometric configuration factor generator based on Nusselt's method. A formulation of Nusselt's method provides the basis for a FORTRAN subroutine NUSSELT. Numerical results from NUSSELT are compared to analytic values and values from Sparrow's method. Sparrow's method is based on a double contour integral and its reduction to a single integral which is approximated by Gaussian methods. Nusselt's method is adequate for the intended engineering applications, but Sparrow's method is an order of magnitude more efficient in many situations. (11 refs.)

Enhancement of radiation cooling by means of reflectors .... See Entry 71339

Empirical equations for calculation of CPC collector loss coefficients .... See Entry 73474

Thermal model of a cylindrically symmetric solar pond .... See Entry 73477

44.50 THERMAL PROPERTIES OF MATTER (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 07.20 Thermal instruments and techniques)

71344 Thermal conductivity of colloidal capillary porous bodies in the process of structure formation. I.M.Lyashkevich, G.S.Raptunovich, L.G.Chernaya (Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.2, p.924-8 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.294-8 (Aug. 1982). [received: April 1983]
Presents the results of the experimental investigation of the thermal conductivity of a solidifying system in the process of formation of a capillary porous structure. (5 refs.)

71345 The thermal conductivity of cylindrical walls. I.S.Kochenov.
Therm. Eng. (GB), vol.29, no.8, p.457 (Aug. 1982). Translation of: *Teploenergetika (USSR)*, vol.29, no.8, p.74 (Aug. 1982). [received: April 1983]
Outlines a method of calculating the maximum drop in temperature in cylindrical walls with a constant coefficient of thermal conductivity under the conditions of an axisymmetric steady-state problem. (4 refs.)

44.60 THERMODYNAMIC PROCESSES (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 05.70 Thermodynamics, 07.20 Thermal instruments and techniques)

Kinetics of isothermal evaporation of a porous or dispersed body .... See Entry 71644

46.00 MECHANICS, ELASTICITY, RHEOLOGY

46.10 MECHANICS OF DISCRETE SYSTEMS

(see also 03.20 General mathematical aspects)

71346 Nutational motion of dynamically tuned gyroscope. Liu Yan-Zhu (Shanghai Jiaotong Univ., China).
Acta Mech. Solida Sin. (China), no.3, p.337-42 (1981). In Chinese.
The dynamically tuned gyroscope is a system of rigid bodies restrained by elastic torsional elements, the torsional moments of which are compensated by the dynamical tuning effect. The nutational motion of the gyroscope is discussed by an asymptotic method containing two time scales. The criterion of stability is given and the nutation drift phenomenon as well as its influence on the tuning condition is treated. (5 refs.)

71347 The response of aircraft to pulse excitation. P.K.R.Bhargov, H.R.Srirangarajan (Structures & Materials Div., Aeronaut. Dev. Establ., Bangalore, India).
Comput. & Struct. (GB), vol.17, no.3, p.335-8 (1983).
Reponse of aircraft, idealised as a two degree of freedom system, to pulse excitation is obtained using Runge Kutta algorithm on a microcomputer MICRO 2200. The procedure is illustrated by a numerical example. (2 refs.)

71348 Identifying vibrations in designing thin-walled structures with elastically attached weights. A.A.Malinin.
Sov. Appl. Mech. (USA), vol.18, no.8, p.752-6 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.90-4 (Aug. 1983).
An appreciable number of instruments, devices, etc. are attached to modern thin-walled structures in quite a few cases. Nonsymmetrical location of these objects relative to the symmetry axis of the structure promotes interaction among the elastic vibrations of the structure in different directions, which makes it necessary to allow for elastically attached weights (elastic subsystems) in the design. By performing a preliminary analysis to determine the partial dynamic and independent stiffness characteristics of weights (elastic subsystems) attached to a thin-walled structure, the author solves the problem of determining the dynamic characteristics of the structure as a whole with allowance for the elastically attached weights. (2 refs.)

Response of two-degree-of-freedom systems to multifrequency parametric excitations .... See Entry 69866

Dynamical behaviour of an oscillator sustained by an intermittent mechanism .... See Entry 69867

46.20 CONTINUUM MECHANICS

(see also 03.40 General mathematical aspects)

71349 Problems of controlling by the right-hand sides of elliptical systems and their application to control of the stress-strain state in shells. V.G.Litvinov, Iu.I.Rubezhanskii.
Appl. Math. & Mech. (USA), vol.46, no.2, p.256-60 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.331-6 (1982).
The problem of controlling by the right-hand sides of elliptical systems is considered for the case when the target function is a function of a maximum, and the set of admissible controls is not convex. The existence of a solution of an infinite-dimensional optimal control problem is proved and problems arising in the course of approximating the latter solution by solutions of the finite-dimensional problems are studied. The problems of controlling the stress-strain state of shells of revolution are used as examples. In this case the largest deviation of the stresses or displacements in the shell from the given values is minimized, with constraints imposed on the strength. (12 refs.)

71350 Optimal analysis of the composite structure with double cylindrical shells. Song Tian-xia (Huazhong Inst. of Technol., China).
Acta Mech. Solida Sin. (China), no.2, p.179-88 (1981). In Chinese.
An unconstrained optimization analysis of the composite structure has been made. In the course of optimization, not only is the hybrid penalty function introduced, a new interpolation for solving one-dimensional optimization problems is also developed. The computer program proposed is applicable to the optimal analysis of ordinary structures. (8 refs.)

71351 Determination of the flexural center of blade profiles by non-orthogonal coordinate difference method. Lu Zhong-ming (Shanghai Power Plant Equipment Res. Inst., Shanghai, China).
Acta Mech. Solida Sin. (China), no.3, p.302-11 (1981). In Chinese.
The flexural center of sections with complex curved boundaries like those of blade profiles is calculated by obtaining solutions for stress functions and warping functions with a non-orthogonal coordinate difference method. To determine the flexural center, a number of lattices that approach in shape the given boundaries should first be chosen and an appropriate non-orthogonal coordinate system taken. Then, after difference schemes are derived with the help of loop integrals in the mesh region, solutions are found by a direct method for the sets of symmetric bond type linear algebraic equations obtained and Romberg's formula is used to numerically integrate the functional values of the mesh points. In conclusion, to demonstrate the precision of the proposed method, some elliptic and semicircular sections are treated and the calculated values satisfactorily approach those of exact solutions. (3 refs.)

71352 Dual methods for optimizing finite element flexural systems. C.Fleury, G.Sander (Aerospace Lab., Univ. of Liege, Liege, Belgium).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.3, p.249-75 (May 1983).
The idea of generalized optimality criterion (GOC), set forth in previous papers for bar, membrane, and pure bending elements is extended to deal with general beam and flat shell elements. The modifications brought to the GOC results in explicit approximations for the behavior constraints that are correct up to the first order, but that exhibit a more complex algebraic form. Indeed, these explicit expressions are no longer merely linear in the reciprocal design variables. However, they continue to be additively separable, and therefore dual methods remain fully applicable, just as in the original statement of the GOC approach. Numerical examples are presented to demonstrate the efficiency of the method. (23 refs.)

71353 Dynamic response of frameworks by numerical Laplace transform. D.E.Beskos (Dept. of Civil & Mineral Engng., Univ. of Minnesota, Minneapolis, MN, USA), G.V.Narayanan.
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.3, p.289-307 (May 1983).
Presents a general method for determining the dynamic response of complex three-dimensional frameworks by dynamic shocks, wind forces or earthquake excitations. The method consists of formulating and solving the dynamic problem in the Laplace transform domain by the finite element method and of obtaining the response by a numerical inversion of the transformed solution. The formulation is based on the exact solution of the transformed governing equation of motion of a beam element, and it consequently leads to the exact solution of the problem. Flexural, axial and torsional motion of the framework members are considered. The effects of damping (external viscous or internal viscoelastic), axial forces on bending, rotatory inertia and shear deformation on the dynamic response are also taken into account. Numerical examples to illustrate the method and demonstrate its merits are presented. (28 refs.)

71354 Application of extended equations of Galerkin to stability problems of rectangular plates with free edges and subjected to uniformly distributed follower forces. H.H.E.Leipholz (Dept. of Civil & Mech. Engng., Univ. of Waterloo, Waterloo, Ontario, Canada), F.Pfendt.
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.3, p.341-65 (May 1983).
Shows how an extended version of Galerkin's method can be used to treat plates with free edges by means of 'beam functions' as coordinate functions. (7 refs.)

71355 Optimization of deformable systems under multicriterion conditions. V.I.Mossakovs'kii, Yu.M.Pochtman, S.M.Semenets.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.51-4 (1983). In Ukrainian.
Sources, specificity and place are discussed for multicriterion problems of designing deformable systems. A general method is suggested for reducing these problems to standard optimization ones. Main attention is paid to authenticity and correct description of the information used. A model of weight-cost optimization of a composite shell working for stability at external pressure is built as an example. (5 refs.)

71356 The loading of a hollow cylinder by moveable loads. V.V.Dubrinin, A.V.Remizov.
Izv. VUZ Mashinostr. (USSR), no.3, p.3-8 (1983). In Russian.
Discusses the case of the loading of a resilient hollow cylinder, moving at the same fixed rate under semi-infinite fixed pressure and a tangential trapezoidal load which is in shear with the normal load. The stresses and deformations set up in the cylinder are investigated. The results can be applied in the analysis and design of tubes, loaded by normal and tangential loads, moving at the same fixed velocity and with different load shears. (3 refs.) *Z.F.V.*

71357 Hetenyi's elastic quarter space problem revisited. L.M.Keer, J.C.Lee, T.Mura (Technol. Inst., Northwestern Univ., Evanston, IL, USA).
Int. J. Solids & Struct. (GB), vol.19, no.6, p.497-508 (1983).
Transform methods are used to solve the problem of an elastic quarter space subjected to tractions on its surface. The analysis uses the reflection principle to formulate problem as the solution of unknown residual surface tractions. A Fourier transform is taken in the direction of the edge of the quarter space. The problem is thereby reduced to decouplable integral equations, which are similar to those for the elastic quarter plane. Field quantities are obtained by performing the appropriate inverse transforms and the present results are compared with those of Hetenyi for the normally loaded case. Additional results are given for the cases of tangential surface loading. (10 refs.)

71358 On the stress in rigid bodies. G.Grioli (Istituto di Analisi e Meccanica, Univ. di Padova, Padova, Italy).
Meccanica (Italy), vol.18, no.1, p.3-7 (March 1983).
The possibility of establishing constitutive equations for rigid bodies is shown. The idea is proposed that the stress of a rigid body is indeterminate. (11 refs.)

71359 Optimum design of plates and shells taking account of the physical nonlinearity. V.V.Bochkarev, V.A.Krys'ko (Saratov Polytech. Inst., Saratov, USSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.620-5 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.52-7 (July 1982). [received: March 1983]
Proposes an approach for the design of minimum weight physically nonlinear shallow plates and shells which are rectangular in plan and are acted upon by a transverse load. The authors introduce constraints on the minimum thickness and stress intensity, and solve the physically nonlinear problem by the method of variable elasticity parameters. The equations of state of a shell are solved by a modified Vlasov-Kantorovich method (variational iterations). (9 refs.)

Beams with cable connected boundaries .... See Entry 71377
Cylindrical flexure of plate on linearly deformable base with action of longitudinal forces .... See Entry 71406
Modeling the discrete coupling of layers in calculating the stability of a two-layered cylindrical shell .... See Entry 71418

46.30 MECHANICS OF SOLIDS AND RHEOLOGY

(see also 62.20 Mechanical properties of solids, as related to microscopic structure)

71360 Stress-strain state near the tip of a butt joint. O.K.Aksentyan, O.N.Lushchik (Moscow Construction Engng. Inst., Moscow, USSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.631-6 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.66-73 (July 1982). [received: March 1983]
Examines the neighborhood of the tip of a compound body representing a rigid connection of three wedges made of different materials. (5 refs.)

A rational method for calculating mechanism maps .... See Entry 73097

46.30C Static elasticity

71361 Analysis of plates and shells by the semi-analytical and semi-discretizing method. He Guang-qian, Zhang Wei-yue (Chinese Acad. of Building Res., China).
Acta Mech. Solida Sin. (China), no.2, p.128-40 (1981). In Chinese.
A semi-analytical and semi-discretizing method for the moment theory analysis of elastic plates and shells is presented. Analytic solutions are first derived which satisfy the relevant fundamental differential equations for all points within the boundaries of the plates and shells and various boundary conditions can be satisfied at suitably chosen discrete points of the boundary by the method of collocation. The present method of analysis covers the solution of plates, elliptic paraboloidal shallow shells with unequal radii of curvature, cylindrical shells, shallow spherical shells as well as hyperbolic paraboloidal shallow shells. Numerical solutions for five different examples are also given. By the present method, the resulting matrix equation can be very easily formed and is of much lower order and takes less computer-time. The final results can meet the precision deemed necessary for the design of plates and shells. Furthermore, it offers a better understanding of the features of the analytic solution as well as a good insight into the distribution of the internal stresses and deformations of the plates and shells. (3 refs.)

71362 The finite element method for thin-walled elastic curved beams. He Fu-bao (Chekiang Univ., China).
Acta Mech. Solida Sin. (China), no.2, p.141-57 (1981). In Chinese.
The stiffness matrices of thin-walled elastic curved beams of open and closed sections are given by the displacement method. The polynomial approach is chosen for the displacement model and the effect of temperature is considered. For thin-walled elastic curved beams of closed section, the author adopts the well-known Ullmanski's hypothesis. The linear element of the cross-section has been utilized by the author to discuss the discrete computation of Saint-Venant's torsional function in accordance with the rule of linear distributional approach. (3 refs.)

71363 Stress formula of large curvature toroidal shells in symmetrical deformation. Huang Yen.
Acta Mech. Solida Sin. (China), no.3, p.380-3 (1981). In Chinese. (1 ref.)

71364 Field redistribution in finite elements—a mathematical alternative to reduced integration. J.F.Olesen (Dept. of Structural Engng., Tech. Univ. of Denmark, Lyngby, Denmark).
Comput. & Struct. (GB), vol.17, no.2, p.157-9 (1983).
A general method for 'redistributing' high-order finite element fields into lower order fields is presented. Occasionally consistent finite element procedures lead to abnormal solutions. The heuristic method of reduced integration has been proposed as a cure and good results have previously been achieved. However, the method of field redistribution presented here is consistent with a variational principle and may for this reason be more appealing. The method is applied to a simple shear flexible beam element and it is shown that in this special case the resultant element stiffness matrix is identical to the one obtained by employing reduced integration. (6 refs.)

71365 Reflections on the computational approximation of elastic incompressibility. I.Fried (Dept. of Math., Boston Univ., Boston, MA, USA).
Comput. & Struct. (GB), vol.17, no.2, p.161-8 (1983).
Gradual diminuation of compressibility tied with mesh refinement is shown to be an effective and practical way to numerically cope with near incompressibility of elastic solids. It is remarked that (low order) numerical integration is a side issue in this technique and that (high order) exact integration of high order finite elements can be safely used with the correct minimal variation principle of classical elasticity, including a high Poisson ratio. (16 refs.)

71366 Application of methods of feasible directions to structural optimization problems. E.A.Sadek (Faculty of Engng., Cairo Univ., Cairo, Egypt).
Comput. & Struct. (GB), vol.17, no.2, p.183-91 (1983).
A general approach to structural optimization, which has received much attention in recent years, is that of using mathematical programming (numerical search) techniques. These techniques may be separated into direct and indirect methods. Of the direct methods of attack on general nonlinear inequality constrained problems, the largest class is called methods of feasible directions. This paper presents the application of Zoutendijk's method of feasible directions to structural optimization problems. The algorithm requires the analytic gradient of the objective function and the constraint functions which are active at a given stage in the design process. A considerable improvement in convergence has been achieved by considering each pushoff factor as a linear function of the corresponding active constraint. A comparison of the half-step versus full-step search procedure is presented. An initial step length based on a present decrement of objective function is used. A discussion of the linear versus quadratic interpolations of a constraint function in search for a bound point is presented. The algorithm is demonstrated with elastic design of a 25-bar space tower, a 3-bay single storey and a double bay double storey rigid jointed plane frames. Data on the differences in the optimum designs obtained from different starting points is reported. (5 refs.)

71367 Orthotropic cylindrical shells under line load along a generator. U.S.Chawla (Solid Mech. Technol., Dominion Engng. Works Ltd., Montreal, Quebec, Canada).
Comput. & Struct. (GB), vol.17, no.2, p.211-16 (1983).
A technique is developed for elastic analysis of an orthotropic cylindrical shell subjected to a uniform line load along a generator. An accurate form of governing differential equations is derived and a mathematically discrete element method is used for its solution. The shell is divided into a finite number of longitudinal strips and the derivatives with respect to the circumferential

coordinate in the governing equation are replaced by their finite difference relationships. The solution of the resulting equations is written in closed form. A computer program to implement this technique is developed and the computed results are compared with published experimental and analytical results. Excellent agreement is obtained. Some new results for a shell with fixed end boundary conditions are also presented. (7 refs.)

71368 Torsion of tube structures: planar formulation. A.Rutenberg, M.Eisenberger (Faculty of Civil Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Comput. & Struct. (GB), vol.17, no.2, p.257-60 (1983).
It is shown that the torsional analysis of tube structures can be performed directly by means of standard plane frame or plane stress finite element computer programs rather than by three-dimensional procedures. By considering in-plane rigidity of the floor slab and the presence of an elastic axis, it is shown that the only modifications required in these programs are the separate assembly of the stiffness submatrices of elements located at different distances from the axis, and the factoring of results by the distance ratios to a reference frame. (7 refs.)

71369 Optimization for structures of discrete-size elements. Hsichun M. Hua (Aero Industry Dev. Center, Taiwan).
Comput. & Struct. (GB), vol.17, no.3, p.327-33 (1983).
An optimization algorithm has been developed for finding the minimum weight design of the structure assembled with the material of discrete sizes. The essence of it is an efficient implicit enumeration of eliminating systematically the nonoptimal solutions. This algorithm is flexible in application with regard to the type of behavior constraints. Therefore, it is applicable to most practical problems of aerospace structure design. Examples are included in the paper to demonstrate the usefulness of this method. (13 refs.)

71370 A study of shear factors in reduced-selective integration Mindlin beam elements. W.L.Mindle, T.Belytschko (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
Comput. & Struct. (GB), vol.17, no.3, p.339-44 (1983).
The influence of the shear correlation factor on the convergence of a reduced-selective integration Mindlin beam element is investigated for structural dynamics problems. This is accomplished through a frequency analysis of an infinite mesh and a single element, which shows that reduction of the shear factor lowers the maximum frequency of the mesh without affecting its spectral fidelity in low and moderate frequencies. This enables larger critical time steps to be used for explicit integration without disturbing convergence of the element. (9 refs.)

71371 Minimum-weight design with displacements constraints in 2-dimensional elasticity. A.Zochowski (Systems Res. Inst., Warsaw, Poland), K.Mizukami.
Comput. & Struct. (GB), vol.17, no.3, p.365-9 (1983).
The optimum weight-bounded deflection design of a beam, modelled by means of a set of two-dimensional elasticity equations is studied. The iterative algorithm based on differentiation with respect to the domain formulae is proposed. Numerical solutions are given for beams, damped on one or on two sides, under different loading conditions. The results are compared with those of a straightforward approach. (12 refs.)

71372 A nonlinear, semi-analytical finite element analysis for nearly axisymmetric solids. M.Sedaghat (Facultad de Ingenieria Civil, Univ. de Concepcion, Concepcion, Chile), L.R.Herrmann.
Comput. & Struct. (GB), vol.17, no.3, p.389-401 (1983).
Describes the development of the theory and accompanying computer program for a semi-analytical finite element analysis of nonaxisymmetrically loaded, nearly axisymmetric solids. The theoretical basis of the method together with numerical procedures for handling boundary conditions, rigid body motion and the iterative solution process are described. A finite element program for evaluating the analysis is discussed, evaluated for effectiveness and applied to several examples. The range of application of the analysis for inhomogeneous, orthotropic, nonlinear and nearly axisymmetric bodies is demonstrated by a series of examples. The substantial savings in computer time and memory are compared to a conventional finite element analysis is discussed. (14 refs.)

71373 A simple selectivity integrated torsion—flexure coupled tapered beam element with transverse shear deformation. B.R.Somashekar (Structures Div., Nat. Aeronaut. Lab., Bangalore, India).
Comput. & Struct. (GB), vol.17, no.3, p.403-6 (1983).
A tapered beam element with torsional flexibility and transvearse sher deformation is developed for use in swept plate studies. Recently established guidelines for selective reduced integration allow the use of independent interpolation functions for the transverse deflection, rotation and torsional rotation to obtain an element that does not lock in extremely thin situations encountered in thin beam/plate analysis. The element is tested for free vibration and for the static case of a severely swept cantilever plate of high aspect-ratio subjected to uniform distributed load. The results indicate very good performance of the element. (8 refs.)

71374 A unified approach for the analysis of bridges, plates and axisymmetric shells using the linear Mindlin strip element. E.Onate, B.Suarez (ETS Ingenieros de Caminos, Jorge Girona Salgado, Barcelona, Spain).
Comput. & Struct. (GB), vol.17, no.3, p.407-26 (1983).
A finite strip formulation is presented which enables one to treat bridges, axisymmetric shells or plate structures of constant transverse cross section in an easily and unified manner. The formulation is based on Mindlin's shell plate theory. One dimensional finite elements are used to discretize the transverse section and Fourier expansions are used to define the longitudinal/circumferential behavior of the structure. The element used is the simple two noded strip element with just one single integrating point. This enables one to obtain all the element matrices in an explicit and economical form. Numerical examples for a variety of straight and curved bridges, axisymmetric shells and plate structures which show the efficiency of the formulation and accuracy of the linear strip element are given. (32 refs.)

71375 A comparison of the linear, quadratic and cubic Mindling strip elements for the analysis of thick and thin plates. E.Onate, B.Suarez (ETS Ingenieros de Caminos, Jorge Girona Salgado, Barcelona, Spain).
Comput. & Struct. (GB), vol.17, no.3, p.427-39 (1983).
The behaviour of the linear, quadratic and cubic elements of the Mindlin plate strip family for thick and very thin plate analysis is investigated. Selective integration techniques are used to ensure the good behaviour of the elements when dealing with thin plates. Numerical results, showing the convergence and accuracy of the elements for the analysis of plates of a wide range of thicknesses, are given. The general performance of the three elements is discussed in detail. In particular, the linear element with a single integration point seems to be the best value strip element for practical purposes. (27 refs.)

71376 Deformation of flexible shells of revolution. Ya.M.Grigorenko, M.M.Kryukov, V.S.Dem'yanchuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.42-6 (1983). In Ukrainian.
A numerical approach is suggested to solve boundary value problems on deformation of flexible shells of revolution of variable thickness in meridian and circular directions under nonuniform loads. Using difference approximation along the circular coordinate a two-dimensional nonlinear boundary value problem is reduced to a unidimensional one which is solved by the linearization method. Examples of numerical solution of particular problems are available. (12 refs.)

71377 Beams with cable connected boundaries. J.Holnicki-Szulc (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.753-64 (1983).
An analysis of beams reinforced by families of cables is presented. Neglecting friction between the two phases of material (the matrix and the family of cables), the influence of reinforcement is nonlocal and caused by the direct connection between boundaries introduced through the cables. Reduction to the case of locally reinforced beams with full adhesion along the fibers is discussed. Comparison between these two models of reinforcement leads to a definition of a global measure of the nonlocality of the problem. The general problem of elastic bodies reinforced by families of cables attached at boundaries is discussed in the Appendix. (10 refs.)

71378 Solutions of the torsion problem for some kinds of bars with multiply connected section. Chen Yi-Zhou (Div. of Solid Mech., North-Western Polytech. Univ., Xian, China), Chen Yi-Heng.
Int. J. Eng. Sci. (GB), vol.21, no.7, p.813-23 (1983).
This paper is a continuation of previous papers by Chen Yi-Zhou (see Engng. Fracture Mech., vol.13, p.193, 1980, ibid., vol.19, p.791, 1981). In the paper the multiply connected region dealt with is a rectangular section containing several rectangular holes. The boundary value problem of such a multiply connected region in the case of torsion problem can be divided into two similar problems. Each one of these problems belongs to a Dirichlet problem of Laplace equation. There is only one undetermined constant K, which is determined from the single value condition of the displacement. When solving these boundary value problems, the original section is divided into several rectangular subregions, and then the Duhem theorem (see Appendix I) is used. After two boundary value problems are solved, the undetermined constant K can be found by using the above mentioned condition. Finally, the torsional rigidity can be easily deduced. Three sets of numerical results are shown. (6 refs.)

71379 The torsion of a microelastic half-space by a flat annular rigid stamp. M.Lal (School of Studies in Math., Jiwaji Univ., Gwalior, India).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.825-32 (1983).
Seeks to solve the problem of an elastic half space under torsion by a flat annular rigid stamp in linear micropolar elasticity. The problem is reduced to the solution of a system of four Fredholm integral equations of the second kind in four unknown functions. An iterative solution of these integral equations has been obtained for $\lambda=a/b\ll1$ for the case of simple rotation through a small angle ω_0 and the corresponding classical results have been obtained. (14 refs.)

71380 The glass as an elastic continuum. D.M.Duffy (J.J. Thomson Phys. Lab., Univ. of Reading, Reading, England).
J. Phys. Colloq. (France), vol.43, no.C-9, p.475-9 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The theory of elasticity of continuous media is applied to amorphous materials, whose symmetry is completely broken. It is shown that a single line defect, a Z_2 disclination, survives the absence of generative symmetry, and that the arbitrariness of the local reference frame can be expressed as a SO(3) gauge symmetry. The authors derive the physical consequences of the existence of these disclinations (two-level systems, Vogel-Fulcher law), and their elastic energy, which is screened down to Coulomb potential by thermal fluctuations in the dislocation part of the incompatibility. (11 refs.)

71381 Thermal stresses in partially absorbing flat plate due to sudden interruption of steady-state asymmetric radiation. I. Convective cooling at rear surface. J.I.Frankel, J.P.Singh, J.R.Thomas,Jr., D.P.H.Hasselman (Dept. of Mech. Engng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
J. Therm. Stresses (USA), vol.6, no.1, p.15-24 (Jan.-March 1983). [received: May 1983]
An analysis is presented of the thermal stresses in a partially absorbing flat plate due to sudden interruption of steady-state asymmetric thermal radiation on the front face with convection cooling at the rear face. Maximum transient tensile stresses occur in the rear surface and are almost independent of the heat transfer coefficient, h. For optical thicknesses of ≥0.5 μa, the maximum tensile stress initially rises to reach a peak and then decreases with time. In contrast, for thicknesses ≤0.5 μa, the stresses decrease monotonically. It is shown that a plot of nondimensional stress as a function of nondimensional time for a given value of μa and h does not result in a universal plot from which thermal stresses can be obtained for any value of plate thickness. (5 refs.)

71382 Thermal stresses in partially absorbing flat plate due to sudden interruption of steady-state asymmetric radiation. II. Convective cooling at front surface. J.P.Singh, J.I.Frankel, J.R.Thomas,Jr., D.P.H.Hasselman (Dept. of Materials Engng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
J. Therm. Stresses (USA), vol.6, no.1, p.25-34 (Jan.-March 1983). [received: May 1983]
For pt.I see ibid., vol.6, no.1, p.15 (1983). Analyses the thermal stresses in a partially absorbing flat plate, due to a sudden interruption of steady-state asymmetric radiation on the convectively cooled front face. As in the case of pt.I, the maximum tensile stresses occur in the rear face. For the optical thickness $\mu a\geq0.5$, the maximum tensile stress initially rises to a peak and then decreases with time. On the other hand, for $\mu a\leq0.5$, the stresses decrease monotonically with time. A comparison of the results for the front (pt.II) and rear (pt.I) cooling indicates that values of the maximum stress are numerically indentical for small values of heat transfer coefficient h, and plate thickness a. Increasing difference in the magnitude of the stresses for the two cases is found with increasing h and a. (3 refs.)

71383 Eigenvalue approach to thermoelasticity. N.C.Das, S.N.Das, B.Das (Dept. of Math., Jadavpur Univ., Calcutta, India).
J. Therm. Stresses (USA), vol.6, no.1, p.35-43 (Jan.-March 1983). [received: May 1983]
The general problem of the one-dimensional linearized simultaneous equations of thermoelasticity has been solved in the Laplace transform domain by following the algebraic eigenvalue approach. This is an alternative which retains the original structure of the problem compared to the recent state space methodology of Bahar and Hetnarski (see ibid., vol.1, p.135, 1978 and vol.2,

p.28, 1979). The use of a thermoelastic potential is thus avoided. The results obtained can be used to a broad class of problems in thermoelasticity or other coupled fields. Applications to problems pertaining to a half space and a layer are presented. (10 refs.)

71384 Thermoelastic polynomials. J.Ignaczak (Polish Acad. of Sci., Warsaw, Poland).
J. Therm. Stresses (USA), vol.6, no.1, p.45-55 (Jan.-March 1983). [received: May 1983]
A theory of thermoelastic polynomials that determine fundamental solutions of a central equation of linear thermoelasticity with finite wave speeds is developed. The polynomials define series solution of the Neumann type for an integro-differential equation on the time axis associated with a method of separation of variables for the central equation. A number of recurrence relations defining basic properties of the thermoelastic polynomials are presented. In particular, it is shown that the polynomials can be identified with an element of the null space of a linear ordinary differential operator. (3 refs.)

71385 Transient thermal stress problem in a tranversely isotropioc finite circular cylinder under three-dimensional temperature field. N.Noda (Dept. of Mech. Engng., Shizuoka Univ., Hamamatsu, Japan).
J. Therm. Stresses (USA), vol.6, no.1, p.57-71 (Jan.-March 1983). [received: May 1983]
Deals with a transient thermal stress problem in a finite circular transversely isotropic solid cylinder subjected to an asymmetrical temperature distribution on a cylindrical surface. The stress fields are found by use of the potential functions method. As an example, the temperature and stress fields for a specific case are computed as a comparison with an isotropic body. (10 refs.)

71386 Eigenvalue approach to magnetothermoelasticity. N.C.Das, A.K.Mitra, R.K.Mahalanobis (Dept. of Math., Jadavpur Univ., Calcutta, India).
J. Therm. Stresses (USA), vol.6, no.1, p.73-92 (Jan.-March 1983). [received: May 1983]
Arranges the equations representing the one-dimensional, linearized, simultaneous, coupled problem of magnetothermoelasticity in the form of a matrix differential equation in the Laplace transform domain. The problem is then converted to an algebraic eigenvalue problem and solved in the same domain. The results obtained can be used to solve a broad class of problems in magnetothermoelasticity. Applications to problems pertaining to a half-space and a layer are presented. The results obtained for some special cases are compared to the results in the literature. (13 refs.)

71387 Notes on the principle of hybrid technique in experimental stress analysis. K.-H.Laermann (Univ. Wuppertal, Wuppertal, Germany).
Mess. & Pruef. (Germany), vol.19, no.4, p.184-90 (April 1983). In German.
Discusses the basic principles of the hybrid technique. Examples show its application to the stress analysis of plates in bending. The hybrid technique combines mathematical and physical models and experiment for the solution of problems which cannot be solved by theoretical or numerical methods. (7 refs.) *J.S.*

71388 The location of centres of torsion and flexure. P.Muller (CNRS, Univ. Pierre et Marie Curie, Paris, France).
Mech. Res. Commun. (GB), vol.9, no.6, p.367-72 (Nov.-Dec. 1982). In French. [received: March 1983]
Expressions for the co-ordinates of the centres of torsion (C_T) or flexture (C_F) are obtained from the three-dimensional problem of Saint-Venant. Except for sections presenting two axes of symmetry the two centres do not coincide, the difference being particularly important in the case of thin profiles of variable thickness. C_T and C_F are defined for an elastic, homogeneous, isotropic, cylindrical beam, encastre at one end and loaded at the other end. The relation between C_T and C_F is investigated mathematically for the case of a beam of constant thickness and a beam of variable thickness. (5 refs.) *H.E.G.*

71389 Determination of stresses in a diffusion coating applied to a rod under tension. V.F.Shatinskii, Yu.S.Safarov, R.N.Garlinskii (Physicomech. Inst., Acad. of Sci., Kiev, Ukrainian, SSR).
Strength Mater. (USA), vol.14, no.5, p.654-63 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.75-82 (May 1982). [received: May 1983]
The method developed and based on general assumptions for applied elasticity theory makes it possible to carry out analytical studies of the stress state for rod shaped articles with a diffusion coating under tension (compression). The equations and analysis proposed make it possible to establish optimum coating layer parameters for specific examples of rod shaped articles. (14 refs.)

71390 Numerical anaysis of stressed state of thin shells with curvilinear holes. E.A.Gotsulyak, V.I.Gulyaev, K.Pemsing, I.S.Chernyshenko (Kiev Inst. of Structural Engng., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.734-40 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.70-7 (Aug. 1983).
The authors develop a finite-difference method for numerical analysis of the stressed and strained state of shells of intricate geometry with curvilinear holes of various shapes. An algorithm is constructed for solving such problems and an analysis of numerical results is presented. (8 refs.)

71391 Solvability of boundary-value problems of the generalized theory of anisotropic shells. I.Yu.Khoma (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.741-8 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.78-84 (Aug. 1983). (10 refs.)

Approximation and numerical solution of contact problems with friction .... See Entry 69863

Plane dynamic problems for elastic incompressible bodies with initial stresses .... See Entry 69878

Sources of stress in two half-spaces .... See Entry 69879

Optimality conditions in axisymmetric problems of elasticity theory .... See Entry 69880

A transformation model of generalized two-dimensional problems of linear elasticity in nonhomogeneous anisotropic medium .... See Entry 69882

Geometrically nonlinear formulation for the axi-symmetric transition finite elements .... See Entry 69883

Hetenyi's elastic quarter space problem revisited .... See Entry 71357

On the stress in rigid bodies .... See Entry 71358

On the formulation of plane strain problems for elastic perfectly-plastic medium .... See Entry 71397

Frictional slip between a layer and a substrate due to a periodic tangential surface force .... See Entry 71399

Stability of a nonlinearity elastic cylinder under side pressure and axial compression .... See Entry 71409

A reinvestigation of post-buckling behaviour of elastic circular plates using a simple finite element formulation .... See Entry 71413

On the convection of a cusp in elastic stability .... See Entry 71416

Oscillations of an elastic inhomogeneous strip caused by moving loads .... See Entry 71420

The response of ring-stiffened elastic cylindrical shell of infinite length to a transverse shock wave .... See Entry 71425

Linearization of the impact of elastic systems .... See Entry 71426

Subharmonic capture of aeroelastic self-oscillations of circular cylinder .... See Entry 71436

Diffraction shift of waves in an anisotropic multiply-connected body on elastically symmetric plane .... See Entry 71437

On the propagation of a thermoelastic wave at a thin infinite plate immersed in an infinite liquid with thermal relaxation .... See Entry 71440

A note on nonlinear elastic wave propagation .... See Entry 71448

The influence of mid-plane normal stress and cross section deformation in free vibrating plates .... See Entry 71449

Propagation of axisymmetric displacement waves in a layered cylindrical shell .... See Entry 71453

An elastic-plastic solution for two-dimensional cracked body with finite element method .... See Entry 71462

Punch and crack problems in transversely isotropic bodies .... See Entry 71480

How 'mixed' is dynamic mixed-mode crack propagation?—a dynamic photoelastic study .... See Entry 71481

An analysis of coupled thermal-elastic contact problems with the finite element method .... See Entry 71489

A finite surface element model for two concentric nearly circular rings in partial contact .... See Entry 71490

Contact problem for an elastic ring pressed into a circular hole in an isotropic plate .... See Entry 71491

The accuracy of plane strain models for the elastic contact of three-dimensional rough surfaces .... See Entry 71496

Method of normal stress differences in photoelasticity .... See Entry 71506

The calculation of a composite cylindrical shell of steel and concrete .... See Entry 73119

46.30J Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation

(inc. rheology of solids)

71392 Homogenization for Kelvin-Voigt linearly viscoelastic bodies. G.Francfort, D.Leguillon, P.Suquet (Dept. de Mecanique Theorique, Univ. de Paris, Paris, France).
C.R. Seances Acad. Sci. Ser. I (France), vol.296, no.5, p.287-90 (7 Feb. 1983). In French.
The homogenization process for a linearly viscoelastic Kelvin-Voigt solid is re-examined in a quasi-static setting. A term of delayed memory appears in the expression of the homogenized stress fields. The associated kernel is explicitly derived. The elastic and instantaneously viscoelastic parts of the homogenized stress field are given in terms of the corresponding homogenized elastic and viscoelastic coefficients. (3 refs.)

71393 Plasticity analysis of slope with different flow rules. E.Mizuno (Dept. of Civil Engng., Nagoya Univ., Nagoya, Japan), W.F.Chen.
Comput. & Struct. (GB), vol.17, no.3, p.375-88 (1983).
The Drucker-Prager model with a non-associated flow rule as well as the associated flow rule is applied to obtain the elastic-plastic large deformation response of a vertical slope of insensitive clay using finite element method. A comparative study of the numerical results is made in the form of load-displacement curves, deformed shape of the slope at failure, limit loads, stress distributions, yielded zones and velocity fields. In addition, the meaning of limit load and failure mechanism is discussed in view of the present progressive failure analysis solution and the previous limit analysis solution. (11 refs.)

71394 Isoparametric finite difference energy method for plate bending problems. V.D.Barve, S.S.Dey (Dept. of Civil Engng., Indian Inst. of Technol., Kharagpur, India).
Comput. & Struct. (GB), vol.17, no.3, p.459-65 (1983).
Incorporates the concept of isoparametry in finite difference energy method making it more powerful and versatile to tackle complex plate bending problems with curved boundaries. This approach overcomes the drawbacks of the finite difference energy method and its application to practical problems is now feasible. In order to estimate the accuracy and reliability of the present formulation several isotropic plates with a variety of planforms are solved and the results are compared with the existing analytical and numerical solutions. (13 refs.)

71395 Approximate analysis of unsteady creep in conditions of stress concentration. Ya.M.Klebanov.
Izv. VUZ Mashinostr. (USSR), no.3, p.9-13 (1983). In Russian.
Nonlinear dependencies are derived, relating directly the external forces and stresses in the zone of their concentrations, assuming an invariant relative distribution of the stresses in the process of loading. The application of these dependencies is exemplified by examining an unsteady creep of a strip with a hole. Experimental data confirm the theoretical predictions. (9 refs.) *Z.F.V.*

71396 Theories of nonlocal plasticity. A.C.Eringen (Princeton Univ., Princeton, NJ, USA).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.741-51 (1983).
Deformation and rate theories of nonlocal plasticity are formulated. Constitutive equations are obtained for elasto-plastic solids extending Levy-von Mises and Prandtl-Reuss theories to include nonlocal effects. Combined elastic-plastic constitutive equations are given. A nonlocal deformation theory is also presented. Thermodynamical restrictions are studied. (13 refs.)

71397 On the formulation of plane strain problems for elastic perfectly-plastic medium. Gao Yu-Chen (Harbin Shipbuilding Engng. Inst., Harbin, China), Hwang Keh-Chih.
Int. J. Eng. Sci. (GB), vol.21, no.7, p.765-80 (1983).
Starting from the 3-dimensional basic equations for elastic perfectly-plastic medium, the author has derived the strain-history-dependent yield conditions and constitutive equations for plane strain problems. For the elastic-plastic evolutionary problems with time-varying boundaries, two contiguity conditions for displacements are given in simple forms. It is proved that for the case $\nu=1/2$ (ν-Poisson's ratio), the equations are hyperbolic, and so, some discontinuities of solutions may occur inside the plastic region. On the other hand,

when $\nu<1/2$, the equations are elliptic, and so, the solutions will be sufficiently smooth inside the plastic region, and discontinuities can occur only across the boundaries between the elastic and the plastic regions. As $\nu\rightarrow1/2$, inner boundary layers will occur within which an abrupt transition takes place. The order of magnitude of the width of the inner boundary layer is estimated. It is proved that the stress discontinuities are impossible disregarding the exceptional case of the traces of elastic cores which shrinks to a line in the limiting state. The various relations for discontinuity gaps (or jumps) are given, both for the case of weak and the case of strong discontinuities. Finally, the basic equation and the corresponding four contiguity conditions are formulated for the stress-rate function, and a theorem for unloading is proved. The results obtained have been successfully applied to the analysis of elastic-plastic near-tip fields of cracks. (4 refs.)

71398 The structure of stress-strain relations in finite elasto-plasticity. L.Palgen (Inst. du Genie Civil, Univ. de Liege, Liege, Belgium), D.C.Drucker.
Int. J. Solids & Struct. (GB), vol.19, no.6, p.519-31 (1983).
The importance of the distinction between rotation in the continuum and material sense is emphasized. Starting from the stability of thin-walled tube test specimens, material stability at finite strains is formulated for any choice of conjugate stress and strain. Normality is investigated when total strain rates are non-integrable. It is the total strain rate minus the instantaneous elastic strain rate that follows normality. The general lack of normality exhibited by the rate of strain of the unloaded body element is evaluated quantitatively. A general criterion for convexity of the yield surface is established, and the effect on convexity of changing the stress definition is examined. (23 refs.)

71399 Frictional slip between a layer and a substrate due to a periodic tangential surface force. M.Comninou, J.R.Barber (Univ. of Michigan, Ann Arbor, MI, USA).
Int. J. Solids & Struct. (GB), vol.19, no.6, p.533-9 (1983).
A solution is given for the problem of an elastic layer pressed against an elastic half-plane and subject to a tangential force varying periodically in time. A loading cycle which initially causes localized slip is followed through unloading and reloading. A limiting load is established below which the steady state of the interface does not involve slip. (9 refs.)

71400 FORTRAN computer program for inextensional bending of a doubly curved shell triangular element. L.S.D.Morley (Royal Aircraft Establ., Farnborough, England).
Int. J. Numer. Methods Eng. (GB), vol.19, no.5, p.647-64 (May 1983).
A FORTRAN computer program is described which calculates physical quantities for a class of shell triangular elements undergoing inextensional bending. These elements are in quadratic parametric representation and may have positive, zero or negative Gaussian curvature. The exact inextensional bending solutions for the rectangular displacement components are cubic in the surface co-ordinates and the curvature changes are relatively slowly varying. (2 refs.)

71401 Bending of a concentrically supported thin circular plate under a linearly varying load along an inner concentric circle. M.R.Shinouda (Faculty of Engng., Alexandria Univ., Alexandria, Egypt).
Indian J. Pure & Appl. Math., vol.14, no.2, p.270-9 (Feb. 1983).
Presents the transverse deflections in a closed analytical form for a thin isotropic circular plate supported on a concentric circle and subjected to a linearly varying load acting along a concentric circle lying within the circle of support. Expressions for moments, shearing forces, etc. are also derived. The three cases of a plate supported along its outer edge, a plate of an infinite diameter and a plate loaded by a couple at its centre are studied as limiting cases of the present problem. The last case has been solved before when the support lies at the outer edge and the results agree with the present work. Since the expressions obtained are difficult to use in normal calculations, the results are also presented in the form of charts covering a wide range of geometric parameters and ready to use for design purposes. (6 refs.)

71402 Letter concerning the paper 'On the double-sliding free-rotating model for the deformation of granular materials'. P.A.Vermeer (Dept. of Civil Engng., Delft Univ. of Technol., Delft, Netherlands), M.M.Mehrabadi, S.C.Cowin.
J. Mech. & Phys. Solids (GB), vol.31, no.3, p.281-6 (1983).
P.A. Vermeer comments that Mehrabadi and Cowin's inspection (see ibid., vol.29, p.269, 1981) of the double-sliding free-rotating model for granular materials has led to some incorrect conclusions. First, their conclusion that the idea of 'free' rotation is inconsistent with the restrictions on the strain rate is incorrect. Secondly, their conclusion that these restrictions ($a\geq0$, $b\geq0$) do not ensure positive energy-dissipation at material points is incorrect. In reply, Mehrabadi and Cowin contend that their conclusions reached in the paper in question are correct. The criticisms of these conclusions by Vermeer are due to misunderstandings on his part. The misunderstandings associated with each of the conclusions contested by Vermeer are described. (6 refs.)

71403 A study on mitigation of stress concentration around a transverse hole in a shaft by means of copper electroplating method. Y.Imamura, S.Sato, K.Ishida, F.Sunaoka.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.43-8 (1982). In Japanese.
Mitigation efficiencies of the stress concentration factors around transverse holes made by the countersinking method in a twisted shaft are measured by means of a copper electroplating method. The results obtained are as follows: (1) stress concentration factors are mitigated by the countersinking method and the mitigation efficiencies of the stress concentrations are maximum 22.5% in the bore surface; (2) in the shaft with a countersunk transverse hole, the stress concentrated locations are the four points on the cross section containing the axis of the hole on the outer shaft surface, and the eight points on the two sections which contain the axis of the hole and incline in the angles of ±45° with respect to the axis of the specimen in the bore surface and the incised surface respectively; (3) optimum countersinking depth is presented corresponding to the shaft and transverse hole diameters. (5 refs.)

71404 Chaotic flow in a model for repeated yielding. G.Ananthakrishna, M.C.Valsakumar (Materials Sci. Lab., Reactor Res. Centre, Tamil Nadu, India).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.69-71 (18 April 1983).
Chaos exhibited by a model introduced in the context of repeated yielding is studied. The model shows an infinite sequence of period-doubling bifurcations with an exponent $\delta=4.67\pm0.1$. The associated one-dimensional map and the projection of the strange attractor are also studied. (13 refs.)

71405 Creep and rupture strength with a nonuniform stress state. V.S.Strelyaev, V.A.Petushkov, V.G.Krivonogov ('Energiya' Sci.-Industrial Assoc., Moscow, USSR).
Strength Mater. (USA), vol.14, no.5, p.577-83 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.10-16 (May 1982). [received: May 1983]
The authors propose a general approach to finite-element investigation of stress-strain states and limiting states, the kinetics of these states in concentration zones during nonisothermal elastoplastic deformation, and creep of structures at high temperatures. Using a bar with fillets, the features of deformation and limiting states in creep are analysed along with the applicability of simplified engineering approaches. Basic parameters of fracture mechanics and laws of damage accumulation in the presence of cracks in the concentration zone are studied. (15 refs.)

71406 Cylindrical flexure of plate on linearly deformable base with action of longitudinal forces. V.V.Vorotyntsev, Yu.P.Zyukin (Odessa Inst. of Structural Engng., Odessa, USSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.648-52 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.88-92 (July 1982). [received: March 1983] (6 refs.)

71407 Three-dimensional theory of inelastic stability. Specific results. A.N.Guz', A.N.Sporykhin (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.671-93 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.3-27 (Aug. 1983).
A three-dimensional theory of the stability of deformed media at large subcritical deformations has been developed, the general properties of the problems have been investigated, general solutions have been constructed, problems of practical importance have been investigated in a three-dimensional formulation, and the characteristic effects have been calculated. (12 refs.)

71408 Stress in an axisymmetric solid, taking account of plasticity. V.I.Prokop'ev (Moscow Civil-Engng. Inst., Moscow, USSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.767-70 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.106-10 (Aug. 1983).
The author considers the problem of an axisymmetric deformed solid under the influence of an axisymmetric load. It is assumed that the load applied leads to small elastoplastic deformations, in certain parts of the solid. An iterative method and a finite element method are used to obtain the solutions. (6 refs.)

Structural analysis by a combined finite element-transfer matrix method .... See Entry 69885

Operator split methods in the numerical solution of the finite deformation elastoplastic dynamic problem .... See Entry 69886

On elastoplastic analysis by boundary elements .... See Entry 69888

Problems of controlling by the right-hand sides of elliptical systems and their application to control of the stress-strain state in shells .... See Entry 71349

Dual methods for optimizing finite element flexural systems ...See Entry 71352

Notes on the principle of hybrid technique in experimental stress analysis .... See Entry 71387

Three-dimensional theory of inelastic stability (general questions) .... See Entry 71417

Approximate representation of dissipation function in case of linear viscoelasticity with variable-amplitude vibrations .... See Entry 71459

An elastic-plastic solution for two-dimensional cracked body with finite element method .... See Entry 71462

Elasto-plastic stress analysis and fatigue life prediction of a freight car wheel under mechanical and cyclic thermal loads .... See Entry 71465

Role of geometry in plastic instability and fracture of tubes and sheet .... See Entry 71467

Effect of microstructure on the upper and lower limits of material toughness in elastic-plastic fracture .... See Entry 71468

Dynamic fields near a crack tip growing in an elastic-perfectly-plastic solid .... See Entry 71469

A longitudinal impact of a slender viscoelastic bar .... See Entry 71487

An approximate method for the solution of some two-body contact problems with creep in the case of an unknown contact area .... See Entry 71492

Some aspects of post-yield contact problems .... See Entry 71495

Strain hardening representation for implicit quasistatic elasto-viscoplastic algorithms .... See Entry 73104

Change in transverse strain coefficient in a plane stress state .... See Entry 73158

Is bone a Cosserat solid? .... See Entry 73625

46.30L Static buckling and instability

71409 Stability of a nonlinearity elastic cylinder under side pressure and axial compression. G.I.Volokitin.
Appl. Math. & Mech. (USA), vol.46, no.2, p.219-24 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.289-95 (1982).
The problem of loss of stability of thick-walled cylinders subjected to inhomogeneous initial stresses, is considered. The analysis is based on the exact three-dimensional equations of neutral equilibrium problems derived by superposing small on finite deformations. The law of the state is determined by a five-constant Murnaghan relationship. Cases are studied of the buckling of circular cylinders subjected to axial load and side internal and external hydrostatic pressure. Results are represented for calculations exhibiting the influence of nonlinearity on the upper critical load as a function of the geometric parameters. (7 refs.)

71410 On the theory of coupled loss of stability in stiffened thin-walled structures. A.I.Manevich.
Appl. Math. & Mech. (USA), vol.46, no.2, p.261-7 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.337-45 (1982).
A system of the principal nonlinear approximation equations is obtained for the problem of loss of stability in stiffened thin-walled structures in the presence of finite displacements, taking into account the presence of a set of local modes with critical loads differing little from each other. A concept of 'modified' local modes is proposed, allowing an estimation of the mode interaction already in the first nonlinear approximation. The possibility of simplification of the final system of equations, taking into account the fact that the local mode length is short compared with that of the overall mode, is shown. It is established that within the framework of the principal nonlinear approximation every local mode in stiffened plates and shells interacts with the overall mode, but there is no explicit interaction between the local modes themselves. A theorem is proved establishing the correlation between the system with one, and with many local modes. The problem of stability of a compressed stiffened plate, i.e. of a wide strut, is solved as an example. The proposed theory can be applied to structures almost equally stable when no local waves form up to the moment of coupled buckling. (12 refs.)

71411 General instability of ring-stiffened cylindrical shells subject to hydrostatic pressure. Hwang Keh-chih, Zheng Zhao-chang (Qing-hua Univ., China).
Acta Mech. Solida Sin. (China), no.3, p.271-86 (1981). In Chinese.
Presents a method for calculating the buckling load and mode shape of a ring-stiffened circular cylindrical shell subject to hydrostatic pressure. According to the composite structure method, a set of differential equations for the stability of the rings and interring shell segments are established separately. With the height of ring cross-section, eccentric distance, sum of cross-sectional area ΣF_r and sum of bending rigidity $\Sigma E_r I_{Gr\alpha}$ kept constant, the number of rings is assumed to tend to infinity, and an equivalent orthotropic shell with appropriate elastic constants is obtained as a zero-order approximation. Further, one can seek for the solution of equations for the ring-stiffened shell in the form of a series. The first term of the series corresponds to the zero-order approximation, i.e. the solution of the above-mentioned equivalent orthotropic shell. The remaining terms represent the correction of various orders, which may serve as an indication of the error arising from substituting the real ring-stiffened shell with the equivalent orthotropic one. (8 refs.)

71412 The theory of post-buckling of structures and its prospects. Huang Yu-ying, Jin Meng-Shi, Lei Guo-pu (Wuhan Huazhong Inst. of Technol., China).
Acta Mech. Solida Sin. (China), no.3, p.397-408 (1981). In Chinese.
Describes the historical background against which post-buckling theory has been developed, its analytical methods and prospects for the theory. (13 refs.)

71413 A reinvestigation of post-buckling behaviour of elastic circular plates using a simple finite element formulation. G.Venkateswara Rao, K.K.Raju (Aerospace Structures Div., Vikram Sarabhai Space Centre, Trivandrum, India).
Comput. & Struct. (GB), vol.17, no.2, p.233-5 (1983).
A modified finite element formulation to study the post-buckling behaviour of elastic circular plates is presented. A discussion on the derivation of nonlinear stiffness matrix for post-buckling analysis is included and the results are compared with continuum solutions. (8 refs.)

71414 Buckling and postbuckling of imperfect cylindrical shells under axial compression. I.Sheinman, G.J.Simitses (Georgia Inst. of Technol., Atlanta, GA, USA).
Comput. & Struct. (GB), vol.17, no.2, p.277-85 (1983).
A solution methodology is described for the complete analysis of a geometrically imperfect, thin, circular, cylindrical shell loaded by a uniform axial compression. The analysis includes prelimit-point behavior, the establishment of critical conditions (limit-point) and postlimit-point behavior. The solution scheme is then used to study the effects of various geometrical parameters (radius to thickness and length to radius ratios) on the response characteristics of an imperfect, unstiffened, thin, cylindrical shell. These effects are assessed for a virtually axisymmetric-type of geometric imperfection. (47 refs.)

71415 On torsional buckling of thin walled I columns with variable cross-section. C.Szymczak (Dept. of Civil Engng., Tech. Univ. of Gdansk, Gdansk, Poland).
Int. J. Solids & Struct. (GB), vol.19, no.6, p.509-18 (1983).
The problem of extreme critical conservative loads of torsional buckling for axially compressed thin walled I columns with variable, within given limits, bisymmetric cross-section, is considered. Using Pontryagin's maximum principle, it has been shown that the critical load of a column with variable cross-section may exceed the bounds defined by critical loads for columns with constant extreme cross-section. On the other hand the extreme loads for flexural buckling are the critical ones for columns with extreme constant cross-section. In the numerical example given, the extreme critical loads for simply supported I column with variable width of flanges and corresponding optimal shapes of flanges are the object of analysis. Moreover, it has been shown that these bifurcation points are symmetric and stable. (8 refs.)

71416 On the convection of a cusp in elastic stability. J.M.T.Thompson (Dept. of Civil Engng., Univ. of Coll., London, England).
J. Mech. & Phys. Solids (GB), vol.31, no.3, p.205-22 (1983).
Because of its dominant role in elastic stability, the unstable-symmetric bifurcation, or cusp catastrophe, is worthy of special study. The author presents a systematic perturbation analysis of the cusped imperfection-sensitivity in a general bifurcational context, to examine its movement and deformation under the influence of further imperfection parameters. The elimination of passive coordinates allows explicit expressions to be derived for the horizontal and vertical shifts and the tilting of the primary two-thirds power-law cusp. The results throw new light on the earlier experiments of Roorda (1968), which are re-examined in some detail. Contours of constant failure load in a two-dimensional imperfection space finally allow the worst types of compound imperfection to be identified. (12 refs.)

71417 Three-dimensional theory of inelastic stability (general questions). A.N.Guz', A.N.Sporykhin (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.581-97 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.3-22 (July 1982). [received: March 1983]
Presents a review and generalizing analysis of the presently relevant questions of the three-dimensional theory of inelastic stability (primarily elastic-plastic, complex media and materials with rheological properties), methods of solution, and, on this basis, specific solutions of three-dimensional problems within the framework of both small and finite subcritical deformations. In discussing the stability criteria of inelastic bodies, as well as works dealing with three-dimensional stability theory, a partial analysis is given of the basic works on two-dimensional stability theory, constructed using hypotheses of the plane-cross-section type, Kirchhoff-Love type, etc. In addition, the present review does not include analysis of the results of applying methods of the theory of the stability of motion to problems of the stability of inelastic bodies. (188 refs.)

71418 Modeling the discrete coupling of layers in calculating the stability of a two-layered cylindrical shell. N.P.Semenyuk, N.B.Boiko (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.615-19 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.46-51 (July 1982). [received: March 1983]
Calculates the stability of shells with discretely connected layers using a mathematical model which is based on substitution of the seam connection of the layers with a connection that is continuous over the entire surface. The stability equations in such an approach coincide with the equations for three layered shells. (3 refs.)

71419 Experimental study of the stability of ribbed conical shells. A.S.Pal'chevskii, Yu.A.Sannikov (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.748-52 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.85-9 (Aug. 1983).
The authors theoretically and experimentally study the effect of discrete rib placement in two directions on the stability of thin-walled shells of constant thickness. (6 refs.)

Structural analysis by a combined finite element-transfer matrix method .... See Entry 69885

Application of extended equations of Galerkin to stability problems of rectangular plates with free edges and subjected to uniformly distributed follower forces .... See Entry 71354

Three-dimensional theory of inelastic stability. Specific results .... See Entry 71407

Dynamic stability of smooth cylindrical shells .... See Entry 71451

46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves, and shocks

(see also 43.40 Mechanical vibrations and shock)

71420 Oscillations of an elastic inhomogeneous strip caused by moving loads. A.V.Belokon.
Appl. Math. & Mech. (USA), vol.46, no.2, p.225-30 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.296-302 (1982).
The problem of the motion of a load on the boundary of an inhomogeneous elastic strip is studied. It is assumed that the load moves at a constant sub-seismic velocity, and a regime of steady harmonic oscillations exists in the moving coordinate system. It is proved that the solution of the problem under consideration can be obtained easily if the solution of the 'appropriate' problem of the oscillations of an inhomogeneous strip is known. Estimates are given of the velocity of the motion and the frequency of the oscillations at which there exists a unique energy solution of the problem. When the oscillations frequency is such that the energy solution does not exist, principles are formulated for extracting the unique solution. (11 refs.)

71421 Oscillations of plates under the action of concentrated loads in an acoustic medium. V.A.Golovanov, A.L.Popov, G.N.Chernyshev.
Appl. Math. & Mech. (USA), vol.46, no.2, p.231-6 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.303-9 (1982).
Steady-state oscillations induced by concentrated forces acting on infinite isotropic and orthotropic plates in contact with a liquid are considered. On the basis of an asymptotic integration of the equations, an approximation method for solving the problem is proposed. Explicit expressions are obtained for the first approximations of an isotropic plate, numerical integration of the equations in an exact formulation is also carried out and a comparison with the approximate analytic solution given. The study makes it possible to break up the initial problem into several simpler problems and to identify the structure of the integrals and simplify the solution method. As a result the authors are able to generalize their method to boundary value problems. A solution of the orthotropic plate problem (which has not previously been considered) is obtained. (9 refs.)

71422 Small oscillations of an orthotropic cylindrical shell containing a liquid covered by rigid endplates. R.A.Marchuk, R.N.Shvets.
Appl. Math. & Mech. (USA), vol.46, no.2, p.237-43 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.310-16 (1982).
The oscillation problem for a Timoshenko-type orthotropic cylindrical shell containing a liquid covered by two movable, rigid endplates is considered. The problem is solved by decomposing the required function in a modified Fourier series. The motion of the shell is described by classical equations, and the shell material itself is assumed to be isotropic. (16 refs.)

71423 Dispersion of nonlinear waves in a rod. V.L.Berdichevskii.
Appl. Math. & Mech. (USA), vol.46, no.2, p.244-9 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.317-23 (1982).
Equations from the linear theory of transverse oscillations of a rod have solutions of the form $e^{i\theta}, \theta=\lambda\xi-\omega t$ if the wave number λ and frequency ω are linked by the dispersion relation $f(\lambda,\omega)=0$. A nonlinear generalization of such solutions and a corresponding dispersion relation is constructed for plane oscillations of an inextensible rod. The basic nonlinear effects, are seen in the fact that the harmonic oscillation $\varepsilon^{i\theta}$ is transformed into an oscillation of the form $\psi(\theta), \theta=\theta(\xi,t)$ where $\psi(\theta)$ is a periodic function of θ_t further in the dispersion relation a dependence on the amplitude of the oscillations arises while the derivatives θ_ξ and θ_t serve as the wave number 'effective' rod characterizing slow mean motion on which rapid oscillations with wave number θ_ξ and frequency θ_t are superimposed. The energy of the effective rod is computed and equations are constructed that describe its evolution. The dispersion relation arises as an equilibrium condition imposed on the effective rod. The author's main purpose is to explain whether the Whitham method in the theory of nonlinear waves is a particular case of the general method of studying functionals that depend upon a small parameter previously proposed. A positive answer to this question is given. (4 refs.)

71424 Dispersion of nonlinear spatial waves in a rod. A.Iu.Beliaev.
Appl. Math. & Mech. (USA), vol.46, no.2, p.250-5 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.324-30 (1982).
A nonlinear generalization of the dispersion equations of three-dimensional oscillations is constructed for an inextensible rod. The dispersion equation is obtained for waves of any amplitude in the closed form, containing a solution of a certain system of two transcendental equations. For small amplitudes the final relationships are given in explicit form, taking into account the nonlinearity in the first approximation. The dispersion relation contains, just as in the linear case, the mean tensile force, the wave number and frequency, as well as the parameters defining the oscillation amplitudes. From the dispersed relation it follows that the larger the oscillation amplitude, the greater the wave velocity. The interaction of the transverse oscillations at different planes, absent in the linear case, is described; the characteristics of the 'effective' rod computed and the corresponding averaged equations constructed. (5 refs.)

71425 The response of ring-stiffened elastic cylindrical shell of infinite length to a transverse shock wave. Yeh Yuh-gong (Inst. of Mech., Acad. Sinica, Beijing, China).
Acta Mech. Solida Sin. (China), no.2, p.208-22 (1981). In Chinese.
A simple, unstiffened uniform circular cylindrical shell is employed as a 'reference structure' and the ring stiffeners treated as 'external' loadings on the uniform shell. Based on the assumption of small perturbation, the coupled effects between the fluid and shell is considered. The real external loading on the shell is the sum of the pressure of the incident shock wave and the scattered waves. In order to avoid the difficulty in the direct inversion of the Laplace transformation, the 'residual potential' method is used. The elastic response of the shell is obtained by a series in terms of all normal modes of

oscillation of the structure, including both the non-extensional and extensional effects in all modes. Calculation was made for two groups of data and curves were drawn from the calculated results, from which some useful conclusions can be reached. The equations derived can be reduced to identical with some equations published by other workers. (11 refs.)

71426 Linearization of the impact of elastic systems. Zhang Wen (Fudan Univ., China).
Acta Mech. Solida Sin. (China), no.3, p.317-25 (1981). In Chinese.
The impact of elastic systems is a complicated nonlinear phenomenon. By an analysis of the fundamental central impact of two elastic solids, the author has demonstrated that this nonlinear impact phenomenon may be linearized, qualitatively and quantitatively, with an equivalent spring and an equivalent initial velocity. Thus, the impact problem of elastic systems may be reduced to an appropriate free vibration initial value problem for a linearized system for which the general solutions are deduced. Numerical examples show that the method proposed is both simple and efficient. (5 refs.)

71427 Vibration analysis of shells of revolution by modal synthesis method. Wang Da-jun, Ren Jun-guo, Chen-Ping (Beijing Univ., Beijing, China).
Acta Mech. Solida Sin. (China), no.3, p.343-51 (1981). In Chinese.
A modal synthesis method is suggested for calculating the natural vibration and seismic response for a shell of revolution. The generator of the shell may be of any form even one consisting of piecewise curves, yet the stiffness and mass matrices of the shell still keep the advantage that they are quasi-diagonal. A computer program and a numerical example illustrating the effectiveness of this method are presented. (2 refs.)

71428 Doubly asymptotic approximations as non-reflecting boundaries in fluid-structure interaction problems. M.Soliman, F.L.DiMaggio (Dept. of Civil Engng. & Engng. Mech., Columbia Univ., New York, NY, USA).
Comput. & Struct. (GB), vol.17, no.2, p.193-204 (1983).
Acoustic approximations are differential relations between induced fluid pressure and velocity in an acoustic medium. The plane wave approximation (PWA) is valid for high frequency response while doubly asymptotic approximations (DAA) are valid at very high and very low frequencies and, in advanced versions, at selected intermediate frequencies. These relations have been applied extensively on the wet surface of submerged structures to completely uncouple the equations of motion of the structure from those of the surrounding fluid. If DAA are used, a different virtual mass matrix and, in the advanced versions, fitting matrices must be evaluated for each structural geometry. The approximations are used on a fluid surface which encloses the structure and has a geometry for which virtual mass and fitting matrices are known. The response is obtained by solving numerically the coupled fluid-structure equations within this approximation to a non-reflecting boundary. A numerical example of the dynamic response of a spheroidal shell is solved using a sphere as the absorbing boundary and the response obtained is compared to exact results. (20 refs.)

71429 A geometrically nonlinear shell finite element for tire vibration analysis. C.J.Hunckler, T.Y.Yang, W.Soedel (Purdue Univ., West Lafayette, IN, USA).
Comput. & Struct. (GB), vol.17, no.2, p.217-25 (1983).
An axisymmetric finite element is developed, which includes such features as orthotropic material properties, doubly curved geometry and both the first and second order nonlinear stiffness terms. This element can be used to predict the equilibrium state of an axisymmetric shell structure with geometrically nonlinear large displacements. Small amplitude vibration analysis can then be performed based on this equilibrium state. The nonlinear path is predicted by using the self-correcting incremental procedure and any point of the path can be checked by using the Newton-Raphson iterative scheme. The present formulation and solution procedure are evaluated by analysing a series of examples with results compared with alternative known solutions. Examples include: free vibration of an isotropic cylindrical shell, a conical frustum, and an orthotropic cylindrical shell; buckling of a cylindrical shell; large deflection of a clamped disk, a spherical cap, and a steel belted radial tire. The final example is a free vibration analysis of the inflated tire and the nature frequencies obtained compared well with published experimental data. (38 refs.)

71430 Optimum design of a first story damping system. M.C.Constantinou, I.G.Tadjbakhsh (Dept. of Civil Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
Comput. & Struct. (GB), vol.17, no.2, p.305-10 (1983).
The optimum design of a first story damping system of multistory shear type structures is considered. Analytical expressions, for the case of stationary white noise ground accelerations, are derived for maximum displacements of each floor. Based on these, suitable objective functions are defined. Parametric study for the determination of the effect of structural damping and structure's flexibility on the second quantities is performed and the optimal design of several structures is carried out. (14 refs.)

71431 Nonlinear supersonic flutter of panels considering shear deformation and rotary inertia. K.Singa Rao, G.Venkatewasara Rao (Aerospace Structures Div., Vikram Sarabhai Space Center, Trivandrum, India).
Comput. & Struct. (GB), vol.17, no.3, p.361-4 (1983).
Nonlinear supersonic flutter of panels is studied for end conditions of simply supported, clamped and partial restraint against rotation by a unified approach. The effect of shear deformation and rotary inertia on nonlinear flutter boundary is studied for various thicknesses of panel. (14 refs.)

71432 Unconditionally stable implicity-explicit algorithms for coupled thermal stress waves. Wing Kam Liu, Ui Fei Zhang (Dept. of Mech. & Nuclear Engng., Northwestern Univ., Evanston, IL, USA).
Comput. & Struct. (GB), vol.17, no.3, p.371-4 (1983).
A new family of unconditionally stable implicit-explicit algorithms for transient coupled thermal stress waves is introduced. Its computer implementation aspects are presented. The mechanical displacement and temperature are used as independent variables and the resulting matrix equations are shown to be symmetric. (12 refs.)

71433 Estimation of the fundamental frequencies of shallow shells by a finite element-isodeflection contour method. D.Bucco, J.Mazumdar (Dept. of Appl. Math., Univ. of Adelaide, Adelaide, South Australia).
Comput. & Struct. (GB), vol.17, no.3, p.441-7 (1983).
A simple, efficient and economic numerical technique for the fundamental frequencies of shallow shells is presented. The technique is based upon the constant deflection contours method combined with the finite element method. In the method, using Galerkin's criterion, the element stiffness and mass matrices are derived from a system of two consistent partial differential equations involving two scalar functions. Several representative examples are included to indicate the efficacy of the method. (20 refs.)

71434 Coupled vibration of a rigid rectangular block bonded to an elastic half-space. Z.Hryniewicz (Tech. Univ. of Koszalin, Koszalin, Poland).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.3, p.329-39 (May 1983).
The characteristics of the coupled vertical, horizontal and rocking vibration of the rigid rectangular block bonded to the elastic half-space medium were explored and examained. An approximate analytical solution has been compared with the exact half-space model solution. Depending on the combination of certain parameters (weight, height of the block and force location) the vibrating block may exhibit resonance at three frequencies. In practical cases the response is dominated by the first resonant peak amplitudes. (10 refs.)

71435 On the investigation of axisymmetric oscillations of a multilayer orthotropic cylinder. O.S.Visoven, M.O.Shul'ga.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.40-2 (1983). In Ukrainian.
A method is suggested to study mechanical properties and natural oscillations of a multilayer hollow cylinder consisting of a finite number of orthotropic layers of different thickness. The method permits the initial boundary value problem to be reduced to an infinite system of recurrence algebraic equations. (4 refs.)

71436 Subharmonic capture of aeroelastic self-oscillations of circular cylinder. M.I.Kazakevich, I.Yu.Grafs'kii.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.46-8 (1983). In Ukrainian.
Presents results of experimental wind-tunnel investigations on the existence of aeroelastic self-excited oscillation stable regimes in a circular cylinder. The 1/3 subharmonic capture ranges are found at flow velocities which are three-fold of the critical flow velocity for the fundamental capture range. The self-excited oscillation frequencies in the fundamental and subharmonic capture ranges are identical and coincide with the natural frequency of the elastically fixed cylinder model. The Strouhl number is also identical and is nearly Sh-0.2. The experimental dependences of aeroelastic self-excited oscillation amplitudes on the flow velocity and of the ranges of the fundamental and subharmonic captures on the degree of flow turbulence are obtained. (6 refs.)

71437 Diffraction shift of waves in an anisotropic multiply-connected body on elastically symmetric plane. O.S.Kosmodamians'kii, L.V.Obodovs'kii, V.I.Storozhev.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.48-51 (1983). In Ukrainian.
The solution of a two-dimensional problem on diffraction of a transverse elastic wave polarized in an axial direction on an arbitrary series of parallel cylindrical cavities or inclusions of elliptical section in an anisotropic body with monoclinic symmetry is constructed as a cylindrical functions series, and is reduced to infinite systems of linear algebraic equations. A numerical example is given. (5 refs.)

71438 Bimodal optimization of vibrating shallow arches. N.Olhoff, R.H.Plaut (Dept. of Solid Mech., Tech. Univ. of Denmark, Lyngby, Denmark).
Int. J. Solids & Struct. (GB), vol.19, no.6, p.553-70 (1983).
A bimodal formulation is developed for the problem of maximizing the fundamental vibration frequency of shallow, elastic arches of given span, volume, length, material, and boundary conditions. Arches with different cross-sectional types are considered, and two simultaneous design variables are used, namely the cross-sectional area and arch centerline functions. Results are also presented for arches with circular centerlines. An effective numerical solution procedure based on successive iterations is constructed, and solutions are obtained for clamped arches of different lengths and minimum constraint values for the cross-sectional area. The numerical results show that bimodality of the fundamental vibration frequency of optimized arches is the rule rather than the exception, and that significant increases of the frequency can be achieved. (13 refs.)

71439 Spurious reflection of elastic waves due to gradually changing finite element size. Z.Celep, Z.P.Bazant (Centre for Concrete & Geomaterials, Technol. Inst., Northwestern Univ., Evanston, IL, USA).
Int. J. Numer. Methods Eng. (GB), vol.19, no.5, p.631-46 (May 1983).
Deals with the case when two uniform grids of different element sizes are separated by a transition zone through which the element size varies gradually, either by a geometric progression or by an arithmetic progression. When the ratio of wavelength to the largest element size is as low as 4:1, the spurious wave reflection is very significant, while for the ratios over 10:1 it is insignificant. Inserting a transition zone with gradually varying element size between the two uniform parts of the grid somewhat mitigates the phenomenon of spurious reflection, but this is significant only when the ratio of element sizes in the uniform grids is small. Varying the element size throughout the transition zone in an arithmetic progression seems slightly better than in a geometric progression. The spurious wave reflection is less pronounced for higher-order elements, in particular for linear strain elements as compared to constant strain elements. The spurious reflection is also less severe for consistent mass than for lumped mass. (11 refs.)

71440 On the propagation of a thermoelastic wave at a thin infinite plate immersed in an infinite liquid with thermal relaxation. S.G.Mondal (Dept. of Math., AKPC Mahavidyalaya, Bengal, India).
Indian J. Pure & Appl. Math., vol.14, no.2, p.185-93 (Feb. 1983).
The frequency equations corresponding to a thermo-elastic plane wave in an infinite thermo-elastic plate immersed in an infinite liquid which is kept at a uniform temperature have been obtained for symmetrical and antisymmetrical vibrations about the vertical axis, taking thermal relaxation into account. The equations are expanded in the case when the plate is very thin. The phase velocity-dispersion relations are obtained when the material satisfies Poisson's condition and for given values of the thermal relaxation, coupling parameters; from these the real values of the wave velocity are predicted. (3 refs.)

71441 Non-linear vibrations of a non-isotropic trapezoidal plate. P.Biswas (Dept. of Math., PD Women's Coll., Jalpaiguri, India).
Indian J. Pure & Appl. Math., vol.14, no.2, p.265-9 (Feb. 1983).
Large amplitude free vibrations of a non-isotropic trapezoidal plate with simply-supported edges have been investigated using Berger's approximate quasi-linear differential equations. (11 refs.)

71442 Scattering of elastic waves by a fluid inclusion. B.Peterson, V.K.Varadan, V.V.Varadan (Dept. of Engng. Mech., Ohio State Univ., Columbus, OH, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1487-93 (May 1983).
The scattering of harmonic elastic waves by a bounded fluid inclusion in an infinite elastic continuum is considered. The formalism is an extension of the *T*-matrix method developed for solid inclusions and cavities in elastic media and elastic solid inclusions in fluid media. The problem that is considered here is somewhat more complicated and shares some similarities with the case of an elastic cavity. For the fluid inclusion, however, the scattering amplitudes

display resonance peaks due to interior resonances of the fluid. The convergence of the truncated series is dependent on the largest wavenumber which in the cases studied here is that in the fluid inclusion. Numerical results are presented for a prolate spheroidal inclusion. (12 refs.)

71443 Finite element eigenfunction method (FEEM) for elastic (SH) wave scattering. J.H.Su, V.V.Varadan, V.K.Varadan (Dept. of Engng. Mech., Ohio State Univ., Columbus, OH, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1499-504 (May 1983).
A finite element eigenfunction method (FEEM) is presented for elastic (SH) wave scattering by cylinders of arbitrary cross section. The problem has been analyzed by enclosing the scatterer within an imaginary circular cylinder. The scattered field outside the circular cylinder is expanded in the usual cylindrical harmonics. The nearfield solution inside the circular cylinder is also assumed to be expanded by a series of eigenfunctions. The eigenfunctions for the nearfield are generated through the standard finite element technique by imposing suitable conditions on the circle. Then both the coefficient of the scattered field and those of the nearfield are found by means of a least-square fit for the continuity conditions across the circle. The solution obtained thereby is considered complete in the sense that both the scattered and the nearfield are solved simultaneously. The validity of this method has been verified by comparing results with calculations from exact analysis and the *T*-matrix method for (a) centered circular cylinder, (b) off-centered circular cylinder, (c) elliptical cylinder, and (d) square cylinder. (8 refs.)

71444 Forced motion of a simple frame subjected to a moving force. C.K.Karaolides, A.N.Kounadis (Dept. of Civil Engng., Nat. Tech. Univ., Athens, Greece).
J. Sound & Vib. (GB), vol.88, no.1, p.37-45 (8 May 1983).
The dynamic response of a simple two-member frame subjected to a constant force moving across its girderwith a constant velocity is discussed. After determining the orthogonality condition for the frame as well as its eigenfrequencies and normal modes, one can easily establish the dynamic response of the frame. Dynamic and static influence lines of characteristic displacements and internal forces are assessed for two different velocities of the moving force. Comparisons between dynamic and static solutions indicate that the dynamic effect of the moving load may be considerable. (9 refs.)

71445 Comment on 'Non-linear vibration of circular plates with transverse shear and rotatory inertia' [and reply]. K.Kanaka Raju, G.Venkateswara Rao (Aerospace Structures Div., Vikram Sarabhai Space Centre, Trivandum, India), C.Y.Chia.
J. Sound & Vib. (GB), vol.88, no.1, p.141-2 (8 May 1983).
Kanaka Raju and Venkateswara Rao comment on Chia and Sathyamoorthy's work (see ibid., vol.78, p.131, 1981), stating that they feel they are entitled to a more critical and consistent comparison of their results (presented in ibid., vol.47, p.179, 1976). In reply, Chia states that he believes that the results presented by Kanaka Raju and Venkateswara Rao are correct. (7 refs.)

71446 Free vibrations of an isotropic nonhomogeneous infinite plate of linearly varying thickness. J.S.Tomar (Univ. of Roorkee, Roorkee, India), D.C.Gupta, N.C.Jain.
Meccanica (Italy), vol.18, no.1, p.30-3 (March 1983).
The free transverse vibrations of the plate have been studied on the basis of classical plate theory. The governing differential equation of motion has been solved by Frobenius method by expressing the transverse displacement as an infinite series. The frequencies corresponding to the first two modes of vibration are computed for different values of thickness variation constant, nonhomogeneity parameter, and different combination of boundary conditions. (5 refs.)

71447 Vibration reduction effect by the action of constant force. Y.Iwata, Y.Kobori (Kanazawa Univ., Kanazawa, Japan).
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.73-8 (Nov. 1982). In Japanese.
There are some cases where the amplitude of hard spring systems under harmonic excitations is reduced by the action of a constant force. In order to explain this phenomenon the response of a single-degree-of-freedom system with the restoring characteristics $ky+\beta y^3$ ($\beta>0$), under both the constant force and the harmonic excitation has been investigated, and the mechanism of the vibration reduction has been developed. As a result, it is found that the reasons for the vibration reduction effect by the action of constant force are (1) the increase of the linear spring constant and (2) the change of the resonant characteristics. Some calculation examples of the vibration reduction effect are also included. (5 refs.)

71448 A note on nonlinear elastic wave propagation. H.Cohen, M.Epstein (Dept. of Civil Engng., Univ. of Manitoba, Winnipeg, Canada).
Mech. Res. Commun. (GB), vol.10, no.1, p.37-44 (Jan.-Feb. 1983).
Presents an extremely concise form of the iterated compatibility relations which are readily useful for finding the basic equations for the higher order waves. Their formulation involves an arbitrary choice of coordinates on the singular surface in space-time. The relations are applied to the equations of motion of a nonlinear elastic solid and the basic equations which govern deformation waves of all orders, $n\geq 2$ are obtained. These equations are analyzed wherein both the growth-decay and induced wave equations are extracted from them. The first of these equations is in general a partial differential equation which is linear for waves of all orders, except $n=2$. The later equations are algebraic in nature and give the induced higher order wave associated with a primary wave of order one lower. Finally an algorithm is given for solving problems in nonlinear elastodynamics which utilizes the wave front expansion. (9 refs.)

71449 The influence of mid-plane normal stress and cross section deformation in free vibrating plates. H.Irretier (Inst. fur Mech., Univ. Hannover, Hannover, Germany).
Mech. Res. Commun. (GB), vol.10, no.1, p.53-61 (Jan.-Feb. 1983).
The classical plate-theory, as introduced by Kirchhoff (1850), assumes, in the form of the hypothesis of nondeformable normals, a linear distribution of the in-plane deformation across the thickness of the plate and also neglects the influence of normal stresses with respect to the middle-plate surface. The influence, in the sense of two-dimensional plate theory, of the in-plane displacements and normal stresses (the secondary effects) on the eigenfrequencies, eigenforms and stress distributions are investigated. For this purpose a simply supported, free vibrating plate is considered by inserting double Fourier series solutions into the different plate equations and then solving these using a Newton-Raphson iteration method. (7 refs.)

71450 Torsional wave propagation in a finite inhomogeneous cylindrical shell under time-dependent shearing stress. K.Venkateswara Sarma (Dept. of Maths., PSG Coll. of Arts & Sci., Coimbatore, India).
Proc. Indian Acad. Sci. Math. Sci., vol.91, no.3, p.201-10 (Nov. 1982). [received: May 1983]
Torsional wave motion in a finite hollow cylinder of piezoelectric material of (622) crystal class, under a time-dependent mechanical boundary condition, is investigated. The inhomogeneity is restricted to the variations of density and other physical constants of the medium as a certain power of the radial distance. The expressions for the displacement and the electric potential of the present solution are compared with those under time-dependent electric boundary condition. Numerical values of the roots of the frequency equation for β-quartz are presented. (4 refs.)

71451 Dynamic stability of smooth cylindrical shells. V.N.Baskakov, A.I.Kostoglotov, L.A.Shevtsova.
Strength Mater. (USA), vol.14, no.5, p.602-5 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.31-3 (May 1982). [received: May 1983]
Experimental studies are presented of the effect of internal static pressure and loading rate on the stability of smooth cylindrical shells loaded by an external pressure pulse. It is found that internal pressure significantly increases the critical load associated with the loss of shell stability, this relation being nonlinear. An increase in loading rate also increased the dynamic load factor. (5 refs.)

71452 Forced vibrations of piecewise-nonhomogeneous regular medium with spherical cavity. N.A.Shul'ga, A.I.Yamkovoi, A.P.Vishtak (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.597-601 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.23-8 (July 1982). [received: March 1983] (5 refs.)

71453 Propagation of axisymmetric displacement waves in a layered cylindrical shell. L.P.Khoroshun, S.V.Kozlov, Yu.A.Ivanov (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.611-15 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.41-5 (July 1982). [received: March 1983]
Using the more exact relations of elasticity and taking into account terms of order 2h/r, the authors solve the problem of axisymmetric wave propagation in a two-layered cylindrical shell. (10 refs.)

71454 Energy characteristics of interference effects in an elastic space and half-space. V.V.Meleshko (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.637-41 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.73-9 (July 1982). [received: March 1983]
Studies the effect of the type of mechanical load on the energy characteristics of harmonic wave motions in infinite and semiinfinite spaces. (15 refs.)

71455 Free and forced vibrations of a circular ring of high curvature. V.Ya.Gecha, E.L.Poznyak (All-Union Sci.-Res. Inst. of Electromech., Moscow, USSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.641-4 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.80-3 (July 1982). [received: March 1983]
Studies both the free and forced in-plane vibrations of a ring of high curvature, with inclusion of the forces of internal friction in the material. Some experimental results are cited. (8 refs.)

71456 Influence of the magnetic field on the phase velocities of surface and volume waves in a perfectly conducting regular layered medium. N.A.Shul'ga (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.693-9 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.28-34 (Aug. 1983).
Magnetoelastic waves in a perfectly conducting regular layer unlimited medium formed by the alternation of two layers of different thicknesses and physicomechanical properties were studied in low- and high-frequency approximations for the case of wave propagation normal to the interfacial planes of the layers (L.Ya. Kosachevskii, 1969). Underlying the investigation was the method of describing the magnetoelastic waves, in nonferromagnetic media, which is also used in the present work, and the Floquet theorem for equations with periodic coefficients. A quantitative analysis of the influence of the magnetic field on the phase velocities of Love surface waves and volume waves in a broad range of frequency variation is performed. (6 refs.)

71457 Analysis of the vibrations of a circular cylinder excited kinematically at the ends. V.T.Grinchenko, G.L.Komissarova (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.699-75 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.35-41 (Aug. 1983). (7 refs.)

71458 Action of weak shock waves on a membrane separating two acoustic half-spaces. V.D.Kubenko, Yu.B.Moseenkov (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.705-11 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.42-8 (Aug. 1983).
If a shell structure immersed in a compressible liquid has large dimensions, and a source of unsteady perturbations is found near its surface, then the interaction can be investigated, considering the problem of the action of a shock wave on an elastic plate or membrane bounding a half-space of a compressible liquid. In this case, it is assumed that the material of the plate has some conditional elastic limit, and in the transition through this limit the plate can be considered as a membrane with tension T equal to the yield stress. The authors consider the action of spherical and cylindrical shock waves on an infinitesimally thin membrane separating two acoustic half-spaces. (9 refs.)

71459 Approximate representation of dissipation function in case of linear viscoelasticity with variable-amplitude vibrations. I.K.Senchenkov (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.719-26 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.56-62 (Aug. 1983).
For linear viscoelastic materials with sufficiently fast relaxation, also for vibrations with sufficiently smooth and slowly varying amplitude, the equation for stress can be approximated in the asymptotic sense with differential equations for amplitude. In this study, the author obtains, on the same premise, the corresponding approximation of the dissipation function averaged over a vibration period for the case of linear viscoelasticity and proposes several simplified models. (9 refs.)

Identifying vibrations in designing thin-walled structures with elastically attached weights ....See Entry 71348

Brittle fracture of plates in tension—relative significance of boundary reflected body and Rayleigh waves ....See Entry 71479

A longitudinal impact of a slender viscoelastic bar ....See Entry 71487

Dispersion of harmonic waves in laminated elastoplastic composites ....
....See Entry 72045

46.30N Fracture mechanics, fatigue, and cracks

71460 Overload retardation models of fatigue crack growth. Huang Yu-shan, Liu Xue-hui, Ni Hui-lin (Northwestern Polytech. Univ., China).
Acta Mech. Solida Sin. (China), no.2, p.257-68 (1981). In Chinese.
Eight overload retardation models of fatigue crack growth are reviewed. Their basic principles are treated and physical concepts explained in detail. A comparison has been made between the eight models with respect to the retardation mechanism, performance and ability to explain a variety of retardation phenomena. It is the authors' view that the Wheeler model can be conveniently used and the Matsuoka model has a clear physical meaning. Comments on the application of the retardation models in the estimation of fatigue crack propagation life and in research on retardation phenomena are also made. (19 refs.)

71461 The stress field near the blunt crack tip. Kuang Zhen-bang (Xian Jiaotong Univ., China).
Acta Mech. Solida Sin. (China), no.3, p.358-64 (1981). In Chinese. (4 refs.)

71462 An elastic-plastic solution for two-dimensional cracked body with finite element method. Zhang Xia-ti (Inst. of Mech., Acad. Sinica, Beijing, China).
Acta Mech. Solida Sin. (China), no.3, p.365-73 (1981). In Chinese. (3 refs.)

71463 A strange convergence property of the Lobatto-Chebyshev method for the numerical determination of stress intensity factors. N.I.Ioakimidis (School of Engng., Univ. of Patras, Patras, Greece).
Comput. & Struct. (GB), vol.17, no.2, p.205-9 (1983).
The Lobatto-Chebyshev method for numerical solution of the Cauchy type singular integral equation of crack problems in two-dimensional elasticity, plates and shells and the determination of the values of the stress intensity factors at the crack tips, is shown to converge for nondifferentiable Holder-continuous or even discontinuous loading distributions as far as the values of the stress intensity factors are concerned. In all cases of differentiable loading distributions it is shown to converge more rapidly than believed up to now. The problems of a simple straight crack and a periodic array of cracks loaded by three nondifferentiable loading distributions are used for the application of the present results. Numerical results for these problems verify and further corroborate the theoretical results. (19 refs.)

71464 Quarter-point elements for curved crack fronts. C.Manu (Structural Analytical Div., Sargent & Lundy, Chicago, IL, USA).
Comput. & Struct. (GB), vol.17, no.2, p.227-31 (1983).
Ingraffea et al. (1980) have presented a consistent method to compute stress-intensity factors from wedge quarter-point element nodal displacements for the straight crack front. The method was generalized to permit functional evaluation of stress-intensity factors along the crack front. The method is now generalized for curved crack fronts. (7 refs.)

71465 Elasto-plastic stress analysis and fatigue life prediction of a freight car wheel under mechanical and cyclic thermal loads. T.J.Thomas, S.Nair (Illinois Inst. of Technol., Chicago, IL, USA), V.K.Garg.
Comput. & Struct. (GB), vol.17, no.3, p.313-20 (1983).
The elastoplastic finite element analyses of a 36 in. diameter freight car wheel, subjected to cyclic thermal loads in presence of mechanical loads and cyclic mechanical loads in presence of thermal loads, were conducted. The stresses and strains computed for these loading conditions were then used to predict the fatigue life of a wheel subjected to a random load history. (35 refs.)

71466 A variable power singular element for analysis of fracture mechanics problems. G.H.Staab (Engng. Mech., Ohio State Univ., Columbus, OH, USA).
Comput. & Struct. (GB), vol.17, no.3, p.449-57 (1983).
A variable power displacement formulated singular element is developed. The stress and displacement fields within the element are expressed in terms of singular and regular components. The singular components of these fields provide a more accurate representation of the singularity than the total field solutions. The problem of a crack terminating at a bimaterial interface is solved for two extreme ratios of singular element radius to crack length. The solution shows that accurate results can be achieved for either case. (15 refs.)

71467 Role of geometry in plastic instability and fracture of tubes and sheet. M.G.Stout, S.S.Hecker (Materials Sci. & Technol. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Mech. Mater. (Netherlands), vol.2, no.1, p.23-31 (April 1983).
Conditions for plastic instability and fracture for biaxially loaded tubes are compared to those for a sheet to assess the role of geometry. Thin-walled tubes of 70-30 brass were loaded in combined axial tension-internal pressure. The strains for diffuse instability, local instability and fracture were measured and compared to results on brass sheet. Uniform deformation (up to diffuse instability) was found to be very sensitive to geometry in agreement with theory. The uniform strain in tubes for axial plane strain is twice that for hoop plane strain and the uniform strain in tubes for balanced biaxial tension is only one third of that for sheet. The strain levels for local instability and fracture did not depend on geometry. No significant differences were found for axial vs. hoop loading in tubes and the critical strain levels for tubes were actually somewhat greater than those for sheet. Although the critical local strains are similar, the amount of useful (general) deformation beyond diffuse instability for tubes is very limited because localization occurs rapidly. If the sheet bulges or is punched the geometry is stable and localization occurs gradually, providing significant post-uniform deformation. (32 refs.)

71468 Effect of microstructure on the upper and lower limits of material toughness in elastic-plastic fracture. M.P.Wnuk, T.Mura (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
Mech. Mater. (Netherlands), vol.2, no.1, p.33-46 (April 1983).
Provides some quantitative relations linking the two bounds of fracture toughness, the lower (K_{ini}) and the upper (K_{ss}), with certain microstructural parameters, such as relative inclusion volume, grain size, average microvoid spacing, average radius of an activated inclusion, number of inclusions contained within the process zone associated with a quasi-static crack, etc. Two limits of material behavior, brittle and ductile, are discussed. Both limits are derived from a single mathematical model which employs the D-BCS concept of 'line plasticity' as developed for a stationary crack, but extends its range of validity onto a moving crack situation. Only the quasi-static limit of motion is considered. (29 refs.)

71469 Dynamic fields near a crack tip growing in an elastic-perfectly-plastic solid. Y.C.Gao, S.Nemat-Nasser (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
Mech. Mater. (Netherlands), vol.2, no.1, p.47-60 (April 1983).
A complete asymptotic solution is given for the fields in the neighborhood of the tip of a steadily advancing crack in an incompressible elastic-perfectly-plastic solid. For Mode I crack growth in the plane strain condition, the following noteworthy results are revealed: (1) The entire crack tip in steady crack growth is surrounded by a plastic region, and no elastic unloading is predicted by the complete dynamic asymptotic solution. (2) Unlike the quasi-static solution, the dynamic solution yields strain fields with a logarithmic singularity everywhere near the crack tip. (3) The stress field varies throughout the entire crack tip neighborhood, but does display behavior which can be approximated by a constant field followed by an essentially centered-fan field and then by another constant field, especially for small crack growth speeds. (4) There are two shock fronts emanating from the crack tip across which certain stress and strain components undergo jump discontinuities. Finally, the Mode III steady-state crack growth is reviewed and, on the basis of Mode I and Mode III results, it is concluded that ductile fracture criteria for nonstationary cracks must be based on solutions which include the inertia effects. (18 refs.)

71470 On statistical moments of fatigue crack propagation. Y.K.Lin (Dept. of Aeronautical & Astronautical Engng., Univ. of Illinois, Urbana-Champaign, Urbana, IL, USA), J.N.Wang.
Eng. Fract. Mech. (GB), vol.18, no.2, p.243-56 (1983).
A new statistical theory is proposed for the analysis of fatigue crack propagation, based on the concepts of fracture mechanics and random processes. Focus is centered on conceivably more useful information of the random time at which the crack size grows to any specific value. Given an initial crack size, recursive relationship is obtained for the statistical moments of this random time for a rather general class of material behaviors, and examples are given for the case where the crack propagation rate is governed by a power law. A procedure to estimate the parameters in the power-law model is also illustrated, using the experimental data of some 7475-T7351 aluminum fastener hole specimens subjected to the excitation of a certain bomber load spectrum. (26 refs.)

71471 On life behavior under spectrum loading. F.Kozin, L.Bogdanoff (Dept. of Electrical Engng. & Computer Sci., Polytechnic Inst. of New York, Farmingdale, NY, USA).
Eng. Fract. Mech. (GB), vol.18, no.2, p.271-83 (1983).
B-models are used to study life in cumulative damage under spectrum loading. The basic elements of scatter in sample cdf's, mean cdf, methods of testing and load interaction are delineated and examined in some detail. Application to one set of life data under spectrum loading is considered. Stationary and nonstationary *B*-models of life under spectrum loading are discussed. (15 refs.)

71472 On the symmetric dynamic fracture of a beam under tensile loading. C.Levy, G.Herrmann (Dept. of Mech. Engng., Stanford Univ., Stanford, CA, USA).
Eng. Fract. Mech. (GB), vol.18, no.2, p.295-304 (1983).
The dynamic fracture response of a long beam of brittle elastic material under tensile loading is studied by means of two different one-dimensional models. If the magnitude of the applied loading is increased quasi-statically to a critical value, two coplanar edge cracks are assumed to propagate across the beam's cross section. The first model parallels that of Freund et al. (see J. Appl. Mech., vol.43, p.112-6, 1976) with the crack length, crack speed and the loading on the fracturing section being determined as functions of time after fracture initiation. The second model is derived by means of energy considerations in the vicinity of the fracturing section. The results obtained from both models are similar except during the final phase of the fracture process. (13 refs.)

71473 Partial closure of cracks at the interface between a layer and a half space. M.Comninou (Dept. of Civil Engng., Univ. of Michigan, Ann Arbor, MI, USA), J.Dundurs.
Eng. Fract. Mech. (GB), vol.18, no.2, p.315-23 (1983).
Treats the crack at the interface between a layer and a substrate. Using a formulation based on dislocations, the problem is reduced to a pair of singular integral equations which can be solved numerically. It is found that a large contact zone exists whenever the interface transmits shear. The dependence of the contact zone size on the load parameters is determined for several combinations of materials. Also the shapes of the open part of the crack are shown for illustration. (17 refs.)

71474 Prediction of failure probabilities for cleavage fracture from the scatter of crack geometry and of fracture toughness using the weakest link model. A.Bruckner (Kernforschungszentrum Karlsruhe, Karlsruhe, Germany), D.Munz.
Eng. Fract. Mech. (GB), vol.18, no.2, p.359-75 (1983).
The weakest link model proposed by Landes and Shaffer (see Fracture Mechanics 12th Conf., ASTM STP 700, p.368-82, 1980) is generalized in order to predict the failure probabilities of real structures with surface cracks and to include the scatter in crack size and crack geometry. The failure probabilities and the distributions of crack depth, of depth to length ratio and of fracture toughness of the failed structures are calculated in this model and compared with the results of the usual probabilistic calculations. (12 refs.)

71475 Sudden twisting of an external circular crack in an infinite medium with a cylindrical inclusion. R.S.Dhaliwal, B.M.Singh (Dept. of Math. & Statistics, Univ. of Calgary, Calgary, Alberta, Canada), J.Vrbik.
Eng. Fract. Mech. (GB), vol.18, no.2, p.417-26 (1983).
The torsional impact response of an external circular crack in an infinite medium bonded to a cylindrical inclusion has been investigated. The infinite medium and cylindrical inclusion are assumed to be of different homogeneous isotropic elastic materials. Laplace and Hankel transforms are used to reduce the problem to the solution of a pair of dual integral equations. These equations are solved by using an integral transform technique and the results are expressed in terms of a Fredhol integral equation of the second kind. By solving Fredholm integral equation of the second kind the numerical results for the dynamic stress-intensity factor are obtained which measure the load transmission on the crack. (7 refs.)

71476 Tabulated stress intensity factor solutions for flawed fastener holes. A.F.Grandt,Jr. (School of Aeronautics & Astronautics, Purdue Univ., W Lafayette, IN, USA), T.E.Kullgren.
Eng. Fract. Mech. (GB), vol.18, no.2, p.435-51 (1983).
Several sets of stress intensity factor solutions are provided for through-the-thickness, corner and surface flawed holes. Results are given for both remote tensile and crack face pressure loading. It is suggested that the crack free pressure solutions can be used with the linear superposition method to analyze many other practical crack problems. The superposition technique is demonstrated with several sets of example calculations. (28 refs.)

71477 Fracture mechanics deliberation of lugs. A.Li, D.W.Hoeppner (Cockburn Centre for Engng. Design, Univ. of Toronto, Toronto, Canada).
Eng. Fract. Mech. (GB), vol.18, no.2, p.467-71 (1983).
Mode I stress intensity factors for a symmetrical lug with a through radial crack emanating from the integral boundary were evaluated with finite element techniques. A new geometric configuration was developed which saves a minimum of 60% in computer time over the traditional configuration. The effect of interference fit and slip fit was investigated by comparing the results

obtained for two different loading conditions; point force and uniform bearing pressure distribution, of which, pin loading yields the larger stress intensity factor. A means of estimating the residual life is also presented. (10 refs.)

71478 The weight function for various boundary condition problems. A.P.Parker (Dept. of Mech. & Civil Engng., North Staffordshire Polytech., Stafford, England), O.L.Bowie.
Eng. Fract. Mech. (GB), vol.18, no.2, p.473-7 (1983).
The familiar weight function '*m*' of Bueckner (1970) and Rice (1972) which is unique to a given cracked geometry may be employed in the determination of stress intensity factors with stress boundary conditions applied to the geometry. There also exists an additional weight function '*m**', also unique to a given gracked geometry, which may be employed in the derivation of stress intensity factors with displacement boundary conditions applied to portions of the geometry. Weight functions '*m*' and '*m**' may be derived simultaneously with an arbitrary crack-line loading. The weight function '*m*' permits the recovery of displacements for a new set of stress boundary conditions, whilst '*m**' permits the recovery of stress for a new set of displacement boundary conditions. In using '*m*' and '*m**' to recover additional information, it is important to recognize the functional dependency of stress intensity on crack length. (7 refs.)

71479 Brittle fracture of plates in tension—relative significance of boundary reflected body and Rayleigh waves. B.Q.Vu (Naval Ocean Systems Center, San Diego, CA, USA), V.K.Kinra.
Eng. Fract. Mech. (GB), vol.18, no.2, p.479-83 (1983).
Large SEN-specimens made of PMMA have been subjected to tensile fracture in a run-arrest mode. The dynamic strain at a point on the crack face was measured for very long times. The amplitudes of the boundary-reflected Rayleigh and longitudinal (plate) waves were found to be roughly equal. On the basis of the fact that in plane elastodynamic problems, the body waves attenuate due to cylindrical expansion, while the Rayleigh waves do not, it has been conjectured in the literature that in experiments involving dynamic crack propagation and/or arrest, the boundary-reflected body waves can be neglected relative to the Rayleigh wave. The authors' experiments show that in the present situation this conjecture is not true. (19 refs.)

71480 Punch and crack problems in transversely isotropic bodies. T.S.Sankar, V.I.Fabrikant (Dept. of Mech. Engng., Concordia Univ., Montreal, Quebec, Canada).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.799-811 (1983).
An exact solution is proposed for the mixed boundary-value problem in a transversely isotropic elastic half-space. Certain arbitrary shear tractions are prescribed inside a circular region, outside of which certain arbitrary tangential displacements are given. The normal stresses are supposed to be known all over the boundary. A particular case is considered, in detail, where normal stresses vanish all over the boundary with the shear tractions vanishing inside the circular region. A closed form expression is obtained for the tangential displacements inside the circular region directly through the displacements outside. As an example, a penny-shaped crack in an infinite transversely isotropic body is considered with arbitrary shear tractions acting on both sides of the crack. The formulae for the tangential displacements inside the circle and the shear stresses outside are obtained. Special cases where uniform shear and a concentrated tangential force arise are also discussed. (5 refs.)

71481 How 'mixed' is dynamic mixed-mode crack propagation?—a dynamic photoelastic study. H.P.Rossmanith (Inst. of Mech., Tech. Univ. Vienna, Vienna, Austria).
J. Mech. & Phys. Solids (GB), vol.31, no.3, p.251-60 (1983).
Dynamic photoelastic fringe recordings associated with rapid curved crack propagation, crack divison and the interaction between moving cracks and elastic waves show global dynamic mixed-mode crack-tip fringe patterns. When analysed by means of *K*-determination procedures an 'apparent' dynamic mixed-mode ratio K_2/K_1 may be defined which turns out to be a function of the particular selection of measurement data points. Experimentally recorded fringe data are compared with numerical results in an attempt to resolve the dynamic photoelastic mixed-mode crack problem. (11 refs.)

71482 Transient thermal stress problem for a circumferentially cracked hollow cylinder. H.F.Nied, F.Erdogan (Lehigh Univ., Bethlehem, PA, USA).
J. Therm. Stresses (USA), vol.6, no.1, p.1-14 (Jan.-March 1983). [received: May 1983]
Considers the transient thermal stress problem for a hollow elastic cylinder containing an internal circumferential edge crack. It is assumed that the problem is axisymmetric with regard to the crack geometry and the loading, and that the inertia effects are negligible. The problem is solved for a cylinder that is suddenly cooled from inside. First the transient temperature and stress distributions in an uncracked cylinder are calculated. By using the equal and opposite of this thermal stress as the crack surface traction in the isothermal cylinder the crack problem is then solved and the stress intensity factor is calculated. The numerical results are obtained as a function of the Fourier number tD/b^2 representing are obtained as a function of the Fourier number tD/b^2 representing the time for various inner-to-outer radius ratios and relative crack depths, where D and b are respectively the coefficient of diffusivity and the outer radius of the cylinder. (10 refs.)

71483 A crack-tip strain model for the growth of small fatigue cracks. K.S.Chan, J.Lankford (Southwest Res. Inst., San Antonio, TX, USA).
Scr. Metall. (USA), vol.17, no.4, p.529-32 (April 1983).
The model is based upon the concept of greater plastic strain, hence crack-tip opening, at the tips of small cracks, which is compatible with their observed rapid growth in comparison with equivalent long cracks. The reduction of crack-tip strain at grain boundaries accounts for transient decelerations in microcrack growth rates. However, for similarly oriented crystallites, the model predicts little or no deceleration, hence nothing resembling a threshold. Some of the data support this result. This would suggest that the concept of the threshold may be invalid insofar as small cracks are concerned. (12 refs.)

71484 Stress system in a plate with a crack under biaxial load. E.E.Onishchenko (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.611-14 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.39-42 (May 1982). [received: May 1983]
The problem of the stress system in a biaxially loaded infinite plate with a crack was solved for a wide range of loads. The comparison of the lines of equal maximum tangential stresses obtained experimentally on a cross-shaped photoelastic model with the data theoretically calculated for an infinite plate made possible the evaluation of the proximity of the stressed state in a specimen working part and in the corresponding region of the infinite plate under various biaxial load parameters. (3 refs.)

71485 Thermodynamics of the propagation process of quasibrittle cracks. Sh.Kh.Khannanov (Acad. of Sci., Ufa, USSR).
Strength Mater. (USA), vol.14, no.5, p.620-4 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.46-50 (May 1982). [received: May 1983]
The author obtained explicit expressions for entropy production and excess entropy production connected with the propagation of quasibrittle cracks. A phenomenological correlation for the speed of crack propagation is derived. (5 refs.)

71486 Elliptical crack under the action of shearing stresses of polynomial form. A.N.Borodachev (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.645-8 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.84-7 (July 1982). [received: March 1983]
On the basis of the use of certain results of potential theory for an elliptical disc the author develops a general law for the variation of the stress intensity factors K_2 and K_3 along the elliptical boundary of a crack in the case when the shearing stresses acting on the crack surfaces are determined by polynomials of arbitrary degree. (9 refs.)

Fracture analysis of a pressure vessel with a semi-elliptical surface-crack by three-dimensional elastic-plastic finite element calculation .... See Entry 70696

On the formulation of plane strain problems for elastic perfectly-plastic medium .... See Entry 71397

Creep and rupture strength with a nonuniform stress state ...... See Entry 71405

On the electrical potential analysis of a cracked fracture mechanics test specimen using the finite element method .... See Entry 71500

J-integral evaluation by resistance strain gauges .... See Entry 71501

Modified Manjoine WOL specimen for J_{Ic} and δ_i tests .... See Entry 71502

The role of microcracking during crack growth in brittle materials .... See Entry 72037

A fracture mechanics analysis of indentation-induced Palmqvist crack in ceramics .... See Entry 72038

The discreteness of fracture .... See Entry 72040

Comment on the article by G.I. Barenblatt 'The discreteness of fracture' .... See Entry 72041

Comment on the discreteness of fracture .... See Entry 72042

Reply to G.I. Barenblatt's comments [on 'the discreteness of fracture'] .... See Entry 72043

The load concentration factor and the statistic theory of crack propagation of a unidirectionally fiber-reinforced composite .... See Entry 73165

Determination of fracture-mechanic properties by using the near-field of dynamically loaded cracks .... See Entry 73216

Some considerations on the modelling of oxide-induced fatigue crack closure using solutions for a rigid wedge inside a linear elastic crack .... See Entry 73277

46.30P Friction, wear, adherence, hardness, mechanical contacts

71487 A longitudinal impact of a slender viscoelastic bar. M.Jilek (Dept. of Phys., Tech. Univ. of Prague, Praha, Czechoslovakia).
Acta Tech. CSAV (Czechoslovakia), vol.28, no.1, p.109-28 (1983).
An analytical solution to the impact of a slender cylindrical bar made from a viscoelastic material upon a stiff half-space is presented. The material in question is supposed to be represented by a generalized Maxwell model; concrete calculations referring to time- and co-ordinate-dependences of deflections, velocities, strains and stresses are processed for a doubled Maxwell model. Quantification of dependences is carried out for two materials with a different viscous influence and also comparison with an elastic case is presented. The analysis confirmed typical viscoelastic features of behaviour of material as e.g. dispersion, decrease of a pulse wave front slope decrease of maximum values of stress and so on. Another less known aspect of the model of a viscoelastic material was shown, namely its filtering properties. The solution can also be applied to other models of viscoelastic materials having a equal form of the relaxation function as the generalized Maxwell model. (9 refs.)

71488 Solution of contact problems with known Green's function. A.S.Kravchuk.
Appl. Math. & Mech. (USA), vol.46, no.2, p.214-18 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.283-8 (1982).
An iteration algorithm is proposed for solving contact problems with a previously unknown contact zone by taking account of friction in the contact zone, when the adhesion and slip zone interface is also unknown. Stability of the algorithm is investigated, and examples are presented. (10 refs.)

71489 An analysis of coupled thermal-elastic contact problems with the finite element method. Chen Wan-ji (Engng. Mech. Res. Center, Polytech. Inst. of Dalian, China).
Acta Mech. Solida Sin. (China), no.3, p.326-36 (1981). In Chinese.
In the analysis of thermal load in heated elastic bodies contacting each other, it is necessary to consider the complex contact heat conducting condition as well as the elastic contact condition besides taking into account the coupling effect. A very effective approach—the mixed finite element method—is proposed. The calculated results show that to solve such a class of problems with complex nonlinear boundary conditions by this method, the calculating and storing time is slightly longer than or equal to that when solving thermal load problems of general linear continuous bodies. (9 refs.)

71490 A finite surface element model for two concentric nearly circular rings in partial contact. H.A.Francis (Charles Stark Draper Lab. Inc., Cambridge, MA, USA).
Comput. & Struct. (GB), vol.17, no.2, p.169-76 (1983).
A numerical model is derived for the plane-stress elastic deformation of two concentric hollow cylinders with acircular contact surfaces. Given the detailed undeformed section geometry, the model computes the circumferential distributions of interfacial pressure and gap, and the distortion of the two free surfaces. The interface is partitioned into axial strip elements with radial displacement nodes at their boundaries and a piecewise linear pressure distribution from node to node. Influence coefficients linearly relating nodal displacements to nodal pressures are computed using a finite Fourier series expansion of the pressure distribution in conjunction with exact expressions for the deformation of a sinusoidally loaded thick ring. The iterative solution of the nonlinear system of node equations entails computing the currently nonzero nodal pressures by matrix inversion and then updating the contact/gap configuration. The model is demonstrated for a 400 node, mul-

tiple-contact interface between a machined shaft and sleeve with measured acircularity profiles. (4 refs.)

71491 Contact problem for an elastic ring pressed into a circular hole in an isotropic plate. M.I.Teplyi (Drogobych Pedogogical Inst., USSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.625-31 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.58-65 (July 1982). [received: March 1983]
Examines an infinite isotropic plate S_1 of unit thickness. The plate contains a circular hole of radius R_3 into which has been pressed an elastic concentric ring S_0 with internal R_0 and external R_1 radii. It is assumed that the ring is in contact with the plate over the entire contour of the hole before and after application of the load. An elastic cylinder S_2 of radius R_2, inserted in a small gap ϵ in the hole in the annular region, is in contact with the inner surface of the ring, and a concentrated force P_0 is applied to the center of the cylinder and presses it against the inner boundary of the ring. Friction between the ring, plate, and cylinder is ignored. (5 refs.)

71492 An approximate method for the solution of some two-body contact problems with creep in the case of an unknown contact area. B.A.Galanov (Inst. of Materials Study, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.711-18 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.49-55 (Aug. 1983).
The three-dimensional contact problem of linear creep theory is discussed. The time-dependent contact problem of ordinary elasticity theory is used to determine the contact pressure, the contact area, and the proximity of the objects in the case of creep. This problem has been solved by the method of successive approximations. The convergence of the method is shown by examples of the contact of pyramidal objects with a half-space. (17 refs.)

71493 Effect of surface roughness on the stress-strain state of rubbing bodies. E.A.Kuznetsov (Inst. of Chem. of High-Molecular-Weight Compounds, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.757-62 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.95-101 (Aug. 1983).
The problem consisted of determining the active working layer in which the basic perturbations caused by roughness are concentrated and establishing the factors which have a predominant effect on the thickness of this layer. The frictional forces which arise on the contact sections are particularly examined. (15 refs.)

71494 An experimental study of three-body abrasive wear. A.Misra, I.Finnie (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
Wear (Switzerland), vol.85, no.1, p.57-68 (15 Feb. 1983).
Three-body abrasive wear has been studied using a column of abrasive contained in a tube and pressed against a rotating metal disc. The weight loss of the disc owing to abrasion was examined as a function of the length of the wear path, load, speed, abrasive size, abrasive hardness, metal hardness and temperature. Scanning electron microscopy was used to investigate the mechanism of material removal. Similarities and differences between three-body abrasion tests and two-body abrasion results are pointed out. (5 refs.)

71495 Some aspects of post-yield contact problems. D.A.Hills (Dept. of Mech. Engng., Trent Polytech., Nottingham, England).
Wear (Switzerland), vol.85, no.1, p.107-19 (15 Feb. 1983).
The mechanics of contact between a frictionless ball and a semi-infinite block of material are well known when the resulting deformation is wholly elastic. If a sufficiently heavy load is imposed, some material will enter the plastic regime and there will be a redistribution of the contact pressure. The nature of the resulting and residual stress field after both single and repeated loadings is discussed. It is shown that in each case a residual tensile stress develops normal to the surface and a residual compressive stress lies parallel to the plane of the surface. A comparison is made between the form of the residual stresses calculated on the basis of rigid plastic behaviour (using the slip line field theory) and on the basis of incremental plasticity (under the assumption that the extended elastic stress field dominates the problem). An extension to the problem is considered involving the repeated random indentation of a block: this models approximately the shot-peening process, and enables the resulting residual stresses to be quantified. (18 refs.)

71496 The accuracy of plane strain models for the elastic contact of three-dimensional rough surfaces. H.A.Francis (Charles Stark Draper Lab. Inc., Cambridge, MA, USA).
Wear (Switzerland), vol.85, no.2, p.239-56 (1 March 1983).
Two finite surface element models for elastic contact (a general model employing a two-dimensional lattice of deflection nodes on the interface and a previously derived plane strain model using a one-dimensional line of nodes) are compared for a set of interfaces between deterministic rough surfaces to assess the minimum degree of topographical anisotropy for which the considerably more convenient one-dimensional model can confidently be used to predict the pressure and gap profiles along a lone perpendicular to the anisotropy direction. The sum of the two contacting surfaces comprises an array of identical sinusoidal peaks and valleys, of peak-to-valley height $2H$, elongated in the y direction by an anisotropy factor α. For a given sum surface and load, the two-dimensional model gives the 'true' pressure of gap at each node, from which are computed, for each node row in the x direction, the mean pressure P, the contact length fraction F and the mean gap G. The one-dimensional model is then applied to each node row to computer F and G for this value of P, and the deviation of the one-dimensional model from the two-dimensional model is expressed as the average differences in F and G/H averaged over all node rows. (10 refs.)

Approximation and numerical solution of contact problems with friction ....See Entry 69863
Beams with cable connected boundaries ....See Entry 71377
Frictional slip between a layer and a substrate due to a periodic tangential surface force ....See Entry 71399
Oscillations of plates under the action of concentrated loads in an acoustic medium ....See Entry 71421
Free and forced vibrations of a circular ring of high curvature ....See Entry 71455

46.30R Measurement methods and techniques

(see also 07.10 Mechanical instruments and techniques, 81.70 Materials testing)

71497 The whole-field analysis of speckle interferometry for displacement and strain analysis. Jin Guan-chang, Zhang Wei-bao, Liu Chun-yang (Dept. of Engng. Mech., Tsinghua Univ., China).
Acta Mech. Solida Sin. (China), no.2, p.223-34 (1981). In Chinese.
A whole-field analysis method of laser speckle interferometry for displacement and strain analysis is described. Three new methods of laser speckle photography, namely, cross-like slotted aperture, rectangular multi-aperture and rotated or displaced aperture methods are proposed. Results of the theoretical analysis and experimental demonstrations of these methods show that the adoption of these methods in laser speckle photography results in a wide filtering range and at the same time a very strong viewing intensity during whole-field analysis, making it possible to obtain a clear and variable sensitivity of the displacement field distribution diagram similar to a holographic interferogram. This will certainly pave the way for speckle interferometry application and make whole-field analysis more practical. (6 refs.)

71498 Photoelastic determination of stress intensity factors in patched cracked plates. A.Subramanian, R.Chandra, M.V.V.Murthy, A.K.Rao.
Eng. Fract. Mech. (GB), vol.18, no.2, p.305-13 (1983).
The influence of patch parameters on stress intensity factors in edge cracked plates is studied by employing transmission photoelasticity. Edge cracked plates made of photo-elastic material are patched on one side only by *E* glass-epoxy and carbon-epoxy unidirectional composites. The patch is located on the crack in such a way that the crack tip is not covered. Magnified isochromatic fringes are obtained by using a projection microscope of magnification 50, converted into a polariscope. Irwin's method is used to compute stress intensity factors from photoelastic data. The reduction in stress intensity factors is presented in graphical form as a function of patch parameters, namely stiffness, location and length. An empirical equation connecting reduction in stress intensity factor and these patch parameters is presented. (16 refs.)

71499 Extrapolation techniques for determining stress intensity factors. W.C.Carpenter (Dept. of Civil Engng. & Mech., Univ. of South Florida, Tampa, FL, USA).
Eng. Fract. Mech. (GB), vol.18, no.2, p.325-32 (1983).
A theoretical basis is developed for the extrapolation technique of Chan, Tuba and Wilson (1970) and Ayres and Siddall (1970) for determining stress intensities from finite elemental results. The conditions for which the technique is valid is presented for the Mode I only, Mode II only, and mixed mode condition. (7 refs.)

71500 On the electrical potential analysis of a cracked fracture mechanics test specimen using the finite element method. W.K.Wilson (Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA).
Eng. Fract. Mech. (GB), vol.18, no.2, p.349-58 (1983).
The use of the finite element method to calculate electrical potential drop vs. crack extension calibration curves for fracture mechanics test specimens is investigated. The influence of finite element mesh size and the use of singular elements at the crack tip are considered. Also, some of the details of the compact specimen geometry and electrical potential set-up are examined. Electrical potential solutions for very deep cracks in the compact specimen were obtained and extrapolated to a limiting case solution. A comparison of some of the solutions generated in this investigation with other available numerical solutions and experimentally measured data was very favorable. (10 refs.)

71501 *J*-integral evaluation by resistance strain gauges. W.A.Kawahara, S.L.Brandon (Sandia Nat. Labs., Livermore, CA, USA).
Eng. Fract. Mech. (GB), vol.18, no.2, p.427-34 (1983).
Under plane stress, the contour integral J is evaluated using strain gauge measurements on a cracked test specimen. Results compare favorably with the conventional compliance technique for experimental J evaluation except at relatively small loads. The technique holds the potential for real-time, single-specimen J evaluation. (17 refs.)

71502 Modified Manjoine WOL specimen for J_{Ic} and δ_i tests. D.M.O'Brien, W.G.Ferguson (Dept. Chem. & Materials Engng., Univ. of Auckland, Auckland, New Zealand).
Eng. Fract. Mech. (GB), vol.18, no.2, p.453-65 (1983).
A procedure is presented by which a modified WOL specimen can be designed to withstand the load required to achieve a δ_i or J_{Ic} test for a low yield strength, high toughness material, using information from the test of a standard WOL specimen that has suffered plastic collapse of its loading arms. The K-calibration for the family of geometries used is obtained from published data fitted to a 2-dimensional half-power series, and the load point and gauge point compliances are obtained through a connected beam model that is calibrated from existing compliance data to imitate a WOL specimen. From these calibrations the J-integral tensile component correction factor is evaluated and found to be applicable for this type of specimen. (17 refs.)

71503 Dynamic characters of anisotropic materials for stress distributions. M.Shibahara, Y.Matsui, H.Aiba (Kanazawa Univ., Kanazawa, Japan).
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.65-72 (Nov. 1982). In Japanese.
The dynamic stress distribution around a circular hole was investigated by using the dynamic photoelastic method repeatedly and the image converter camera IMACON-790. The specimens containing the circular hole were made from the epoxy resin isotropic plate or the glass-fiber/epoxy laminate orthotropic plate in which the glass-fiber was arranged either parallel to or at right angles to the impact direction. These specimens were loaded dynamically by the falling impact indentor, and the orthotropic characters depending on the glass-fiber were clarified. The results show that the stress concentration is reduced and that the orthotropic specimen behaves similarly to the isotropic specimen, when the glass-fiber is arranged at right angle to the impact direction. On the other hand, however, in the case when the glass-fiber was arranged parallel to the impact direction, the orthotropic specimen showed very different behaviour in comparison with the isotropic specimen, i.e. the Young's modulus and the stress concentration around the circular hole increased. (4 refs.)

71504 Introduction to modal analysis. I. E.Ossner (Fachhochschule Augsburg, Augsburg, Germany).
Mess. & Pruef. (Germany), vol.19, no.4, p.181-3 (April 1983). In German.
Describes modal analysis as the determination of the modes of natural vibration of structures with their natural frequencies and the corresponding amplitudes, with special reference to the transfer function of a system with one degree of freedom, and to the frequency characteristic function. (3 refs.) *J.S.*

71505 Equipment for testing shell stability at high temperature. P.G.Zykin, V.V.Vasil'ev (Ufa Aviation Inst., Ufa, USSR).
Strength Mater. (USA), vol.14, no.5, p.709-12 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.120-3 (May 1982). [received: May 1983]
A structure has been proposed for modeling gas pressure on a test shell of complex shape by discrete forces using pairs of hydraulic rams. The nature of wave formation during stability loss in shell loaded by means of discrete forces corresponds to wave formation with gas pressure loading. Results have been obtained for experimental study of shell stability in order to develop design programs in a computer. (4 refs.)

71506 Method of normal stress differences in photoelasticity. Yu.I.Vologzhaninov, S.G.Demidenko, A.V.Churpita (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.8, p.763-6 (Aug. 1983). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.8, p.102-5 (Aug. 1983).
The optical path difference σ and isocline parameter ϕ are measured in the polarization-optics method of investigating stresses. These quantities govern the tangential stress τ and the difference between the normal stresses $r=\sigma_x-\sigma_y$. To separate σ_x and σ_y, the method of the difference between the tangential stresses is used as a rule, which is based on the numerical integration of the equilibrium equations by using the quantity τ. Inevitable errors in measuring ϕ near the axes of symmetry influence the accuracy in determining τ substantially. Equations are derived that relate σ_x and σ_y to r. The solutions of their corresponding difference equations are obtained and the procedure for separating σ_x and σ_y by the method of the difference in the normal stresses is elucidated. (7 refs.)

Computer aided determination of internal forces in bar frame structures in real time from tensometric measurements. I .... See Entry 70042

Fracture analysis of a pressure vessel with a semi-elliptical surface-crack by three-dimensional elastic-plastic finite element calculation .... See Entry 70696

Separation of the absolute retardation fringes by using polarizing holography .... See Entry 71087

An ultrasonic bridge for the study of viscoelastic properties of thin interface films .... See Entry 71321

The weight function for various boundary condition problems .... See Entry 71478

How 'mixed' is dynamic mixed-mode crack propagation?—a dynamic photoelastic study .... See Entry 71481

Effect of indenter geometry on controlled-surface-flaw fracture toughness .... See Entry 73293

Method of analysis of fatigue under complex loading .... See Entry 73301

46.60 RHEOLOGY OF FLUIDS AND PASTES

71507 Slow motion of a sphere through an anisotropic, viscoelastic fluid. V.S.Volkov.
Appl. Math. & Mech. (USA), vol.46, no.2, p.185-9 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.248-53 (1982).
Slow motion of a rigid sphere through an incompressible, linear anisotropic viscoelastic fluid of general type is studied. Expressions for the force and moment acting from the fluid towards the sphere are obtained. The results obtained can be used in constructing a theory of viscoelasticity of concentrated polymer solutions and melts where the mobility of the polymer chains is strongly anisotropic. (9 refs.)

71508 Viscoelastic shear thinning of liquids. A molecular-dynamics study. D.M.Heyes (Dept. of Chem., Royal Holloway Coll., Univ. of London, Egham, England), C.J.Montrose, T.A.Litovitz.
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.611-35 (April 1983).
A molecular-dynamics investigation into the microscopic response of simple liquids subjected to severe shearing conditions is discussed. The quantitative behaviour of a model Lennard-Jones liquid and experimental data on more complicated molecular fluids at high levels of stress are strikingly similar, provided appropriate adjustments of characteristic relaxation time-scales are made. The simulations give insights into the structural origin of material failure at high shear stresses and reveal, at high pressures, a restructuring of the medium into layers, which permits easier flow and hence reduces its viscosity. This change is also manifest in an increase of internal pressure (at constant volume) and a decrease in low-frequency shear rigidity modulus and thermal conductivity. Associated temperature distributions in the nonlinear region of viscosity are consistent with macroscopic continuum theory, suggesting that the thermal effects due to shear are essentially decoupled from any parallel structural changes. (47 refs.)

71509 Transient structures and rheological properties of SBS block copolymer melts. N.Sivashinsky, Tak Jin Moon, D.S.Soong (Dept. of Chem. Engng., Univ. of California, Berkeley, CA, USA).
J. Macromol. Sci. - Phys. (USA), vol.B22, no.2, p.213-29 (1983).
Shear stress growth and relaxation behavior of two well-characterized SBS block copolymers have been studied using a melt elasticity tester. Effects of casting solvents on the transient rheological properties and structure variation during flow are determined via samples cast from THF/MEK and cyclohexane. The temperature dependence of the observed shear stress at the yield point and steady-state viscosities provides insight into the mechanism of structure breakdown induced by the applied flow. Shear stress relaxation upon cessation of flow reveals complex behavior, depending on temperature, casting solvents, and duration of previous flow. Strain recovery data have also been obtained, indicating strong dependence on the composition of the copolymers. The significance of these observations in terms of the melt structure of SBS is discussed. (28 refs.)

Examination of the formation of finite disturbances in the course of the convection of a viscoelastic liquid within a horizontal layer .... See Entry 71556

Transient processes in shear flows of a viscoelastic fluid. III. Elastic recovery .... See Entry 71570

Peristaltic flow of viscoelastic liquids .... See Entry 71651

Study on physical properties of cement paste and mortar at early age by ultrasonic pulse method .... See Entry 73124

47.00 FLUID DYNAMICS

(for fluid dynamics of quantum fluids, see 67.; for geophysical fluid dynamics, see 92.10; for astrophysical gas dynamics, see 95.30; for biological fluid dynamics, see 87.45)

47.10 GENERAL THEORY

(see also 03.40G Mathematical aspects)

71510 Nonlinear truncation error analysis of finite difference schemes for the Euler equations. G.H.Klopfer (Nielson Engng. & Res. Inc., Mountain View, CA, USA), D.S.McRae.
AIAA J. (USA), vol.21, no.4, p.487-94 (April 1983).
Finite difference solutions to nonlinear equations governing fluid flow often exhibit large errors in the vicinity of discontinuities or steep gradients. The author details a technique for analyzing these errors through use of modified equation approach. Once the leading error terms are identified, a procedure is demonstrated whereby these terms can be removed as the solution proceeds. The resulting corrected solution is shown to be much improved at discontinuities. In order to illustrate this technique, the modified equation is developed to fourth order for both general classes of two-step Lax-Wendroff schemes (1960) and the implicit schemes due to Beam and Warming (1978). Both the applied to the one-dimensional Euler equations. Solutions of the one-dimensional shock tube problem are obtained, both with and without removal of the leading error terms. (13 refs.)

71511 Conservation form, in general non steady coordinates, of the Navier-Stokes equations and boundary conditions for a moving boundary problem. M.Strain (Istituto di Macchine e Tecnologie Meccaniche, Facolta di Ingegneria, Roma, Italy).
Meccanica (Italy), vol.18, no.1, p.8-15 (March 1983).
The conservative form of the complete set of Navier-Stokes equations and boundary conditions for the flow field of two immiscible fluids separated by a moving interface of unknown shape, is obtained with reference to a boundary fitted system of non steady general coordinates. The method applied to obtain the set of equations as the limit, in the case of small relative velocities, of the corresponding set in the frame of relativistic fluid mechanics, seems particularly direct and appropriate to express the boundary conditions on the moving interface. The immediate extension of the method to treat different kinds of interfaces of discontinuity is also discussed. (10 refs.)

71512 Effects of interfacial transport on the equilibrium fluctuations in fluid layers. D.Gutkowicz-Krusin (Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA), I.Procaccia.
Phys. Rev. A (USA), vol.27, no.5, p.2585-602 (May 1983).
Complete hydrodynamic theory of the dynamics of equilibrium fluctuations in one-component fluid layers confined by rigid solid boundaries is presented. The dynamic structure factor for such a fluid layer is shown to have both diagonal and off-diagonal elements which depend on the layer height L and on the transport of energy and tangential momentum across the fluid-solid interfaces. The effects of interfacial energy transport have been analyzed in the limits of maximum or vanishing tangential momentum transport ('stick' or 'slip' boundary conditions on the velocity field). In the presence of interfacial transport, two new propagating modes have been found for each distinct interface. In the limit of maximum energy and/or tangential momentum transport, the new modes differ from the bulk sound modes only by an increased attenuation coefficient. Additional dissipation is in part due to shear created by the boundaries and, in part, since the sound is not isothermal, to heat conduction between the fluid and solid. In the dynamic structure factor, the new modes appear as additional peaks in the vicinity of the Brillouin peaks of the unbounded fluid; for wave vectors typical of light scattering experiments these peaks are found to be significant for $L\sim100$ μm. Since the positions and line shapes of these peaks are very sensitive to interfacial transport, their study may provide a useful experimental probe of transport across the fluid-solid interfaces. (7 refs.)

Investigation of numerical methods for solving the N-S equations .... See Entry 69889

Classification of difference schemes of gas dynamics by the method of differential approximation. I. One-dimensional case .... See Entry 69890

On the construction of *K*-consistent difference schemes of gas dynamics .... See Entry 69892

47.15 LAMINAR FLOWS

71513 Charge generation in low dielectric constant liquids. H.L.Walmsley (Thornton Res. Centre, Shell Res. Ltd., Chester, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.45-52
A theoretical model for the charge generated by the laminar flow of low dielectric constant liquids through infinitely long pipes has been extended to cover turbulent flow in infinitely long pipes and then, with some additional restrictions, turbulent flow in pipes of finite length. In the present paper the author summarises the results of the above modelling and highlights the influence of various physical processes on charge generation by comparing the currents obtained with laminar and turbulent flows, long and short pipes, and with equilibrium and non-equilibrium boundary conditions. (13 refs.)

Analysis of natural convection using penalty finite elements: laminar flow analysis and turbulent flow analysis by mixing length theory .... See Entry 70644

Shear-flow instability at the interface between two viscous fluids .... See Entry 71517

Natural convection heat transfer in air about a horizontal circular nonisothermal cylinder .... See Entry 71552

Heat transfer in the nonisothermal flow of an anomalously viscous fluid in a helical duct .... See Entry 71554

Vortex-front propagation in rotating Couette-Taylor flow .... See Entry 71573

On the theory of dispersion of a solute during laminar flow in tubes .... See Entry 71647

Effect of sedimentation on Taylor diffusion .... See Entry 73375

47.15C Laminar boundary layers

71514 Investigation of the influence of the unit Reynolds number of the transition of a boundary layer on a sharp cone. V.Ya.Borovoi, Yu.Yu.Kolochinskii, L.V.Yakovleva.
Fluid Dyn. (USA), vol.17, no.4, p.513-19 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.32-8 (July-Aug. 1982). [received: April 1983]
To establish the influence of the unit Reynolds number on the transition of a boundary layer on the side surface of a cone, the transition was investigated on a model of a sharp cone with half-angle $\theta=7.5°$ and lengths from 150 to 400 mm. The experiments were made in a shock tube at Mach number $M_\infty=6.1$ in the wide range of Reynolds numbers $Re_{eL}=1.3\times10^6$-5.5×10^7. The position of the transition region was determined from the results of measurement of the local heat flux by calorimetric thermocouple converters. Data were obtained on the influence on the transition of the unit Reynolds number at large values. It was also shown that under the investigated conditions the base region does not influence the transition of the boundary layer on the surface of the cone. (9 refs.)

Influence of the angle of attack on the transition from a laminar to a turbulent boundary layer in the case of supersonic flow past sharp circular cones .... See Entry 71515

Influence of finite slot size on boundary layer with suction or injection .... See Entry 71534

Nonsimilar boundary layers on the leeside of cones at incidence .... See Entry 71535

Slow flow of gas past a strongly heated sphere in the presence of blowing and evaporation from its surface .... See Entry 71536

Heat transfer in micropolar boundary layer flow over a flat plate .... See Entry 71550

Free-convection heat transfer on a vertical surface with a temperature discontinuity .... See Entry 71553

Numerical study of incompressible flow about immersed elastic boundaries .... See Entry 71563

Long eddies in sheared flows .... See Entry 71587

Secondary instability of wall-bounded shear flows .... See Entry 71652

47.15F Stability of laminar flows

71515 Influence of the angle of attack on the transition from a laminar to a turbulent boundary layer in the case of supersonic flow past sharp circular cones. A.Ya.Yushin.
Fluid Dyn. (USA), vol.17, no.4, p.622-5 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.160-3 (July-Aug. 1982). [received: April 1983]
Some results are given of an experimental investigation into the influence of the angle of attack on the transition in the symmetry plane of a sharp cone at mach number M=6.1. These results and available experimental data are used to establish the dependence of the transition Reynolds number on the angle of attack on the flow devision line of sharp circular cones. (11 refs.)

Investigation of the influence of the unit Reynolds number of the transition of a boundary layer on a sharp cone .... See Entry 71514

Temporal development of the Taylor vortices in a rotating fluid. V .... See Entry 71571

Secondary instability of wall-bounded shear flows .... See Entry 71652

47.20 HYDRODYNAMIC STABILITY

71516 On stability of non-parallel flows and the continuous spectrum. M.Bouthier (Lab. de Mecanique Theorique, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.8, p.593-6 (28 Feb. 1983). In French.
Concerning non-parallel flows, the continuous spectrum is proved to be two-dimensional and a formula for the related wave packet is given. (4 refs.)

71517 Shear-flow instability at the interface between two viscous fluids. A.P.Hooper, W.G.C.Boyd (School of Math., Univ. of Bristol, Bristol, England).
J. Fluid Mech. (GB), vol.128, p.507-28 (March 1983).
Considers the linear stability of the cocurrent flow of two fluids of different viscosity in an infinite region (the viscous analogue of the classical Kelvin-Helmholtz problem). Attention is confined to the simplest case, Couette flow, and the authors solve the problem using both numerical and asymptotic techniques. They find that the flow is always unstable (in the absence of surface tension). The instability arises at the interface between the two fluids and occurs for short wavelengths, when viscosity rather than inertia is the dominant physical effect. (16 refs.)

71518 Dissipative dynamical systems and Rayleigh-Benard experiments. A.Libchaber, S.Fauve (Lab. de Phys., Ecole Normale Superieure, Paris, France).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.195-207
Reviews some Rayleigh Benard experiments in the framework of dissipative dynamical system theory. The Fourier transform technique is used. (37 refs.)

A method of predicting unsteady turbulent flows and its application to diffusers with unsteady inlet conditions .... See Entry 71532

The onset of chaos in convecting fluids .... See Entry 71558

On the completeness of Trkalian motions of Navier-Stokes fluids .... See Entry 71562

Experiments on wave number selection in rotating Couette-Taylor flow .... See Entry 71572

Influence of liquid viscosity and Coriolis force on the stability of internal waves .... See Entry 71577

Long eddies in sheared flows .... See Entry 71587

Viscous stability of compressible axisymmetric jets .... See Entry 71618

Experimental investigation of flow rate and thrust characteristics of a four-nozzle ejector with swirling flow .... See Entry 71624

Nonlinear stage of the shearing instability in a stratified liquid of finite depth .... See Entry 71626

Internal mixing in stratified fluids .... See Entry 71628

Convective instability of a homogeneous fluidized bed .... See Entry 71638

Secondary instability of wall-bounded shear flows .... See Entry 71652

Hydromagnetic waves in a differentially rotating sphere .... See Entry 73720

47.25 TURBULENT FLOWS, CONVECTION, AND HEAT TRANSFER

71519 Turbulent velocity fluctuations that control mass transfer to a solid boundary. J.A.Campbell, T.J.Hanratty (Univ. of Illinois, Urbana, IL, USA).
AIChE J. (USA), vol.29, no.2, p.215-21 (March 1983).
The relation between the velocity and concentration fields for a fully developed turbulent flow which transfers mass to a pipe wall at large Schmidt numbers has been studied. Measurements of the fluctuations of the concentration gradient and the velocity gradient were obtained simultaneously at multiple locations on the wall. Spatial scales were calculated for the low frequency velocity fluctuations by passing the measured signals through low-pass filters. These scales are the same size as the scales of the concentration fluctuations. This result provides additional support for the notion that mass transfer to a boundary at high Schmidt numbers is controlled by low frequency velocity fluctuations which contain only a small fraction of the total turbulent energy. (14 refs.)

71520 Mechanism of turbulent mass transfer at a solid boundary. J.A.Campbell, T.J.Hanratty (Univ. of Illinois, Urbana, IL, USA).
AIChE J. (USA), vol.29, no.2, p.221-9 (March 1983).
Mass transfer between a turbulent fluid and a solid boundary is considered for the case of large Schmidt numbers. The variation of the mass transfer coefficient with time, $K(t)$, is calculated by solving the mass balance equation using a random velocity input. An interpretation of the mass transfer process which is radically different from that given by classical approaches is obtained. (20 refs.)

71521 On circulation-preserving complex-lamellar motions with steady streamlines. A.W.Marris, Wan-Lee Yin (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
Arch. Ration. Mech. & Anal. (Germany), vol.82, no.2, p.109-15 (1983).
Although the circulation-preserving property is defined in terms of a material description of fluid flow, an equivalent condition, referring to the existence of the acceleration potential, presents a differential equation for the flow velocity in the Eulerian description: $\partial/\partial t$ curl $\nu-$curl $(\nu\times$curl $\nu)=0$. This equation can be useful, when affiliated with other defining assumptions of purely geometrical types, for investigating the nature of the field of flow in specific classes of circulation-preserving motions. The authors introduce additional assumptions requiring the streamlines (but generally not the velocity magnitude) to be steady and to form a congruence of curves normal to a family of surface (complex-lamellar flows with steady streamlines). These assumptions by themselves can be used to extract from the preceding equation a simple relation, valid at each instant and along each vortex line, between the flow speed and the local spacing of the normal surfaces of the velocity vector. (2 refs.)

71522 Negative viscosity effect in large-scale turbulence. Long-wave instability of a periodic system of eddies. G.I.Sivashinsky (School of Math. Sci., Tel-Aviv Univ., Tel-Aviv, Israel).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.152-4 (25 April 1983).
The effect of negative viscosity in large-scale turbulence may be understood as a long-wave instability of a system of small-scale eddies supported by external energy sources. (18 refs.)

71523 Product integration methods for the nonlinear Basset equation. S.McKee (Computing Lab., Univ. of Oxford, Oxford, England), A.Stokes.
SIAM J. Numer. Anal. (USA), vol.20, no.1, p.143-60 (Feb. 1983).
Product integration methods are derived through backward difference interpolation for the solution of a nonlinear generalisation of the Basset equation; this equation models the motion of a particle in a turbulent fluid at reasonably high Reynolds numbers. It is proven that the production integration algorithm using $n+1$ points with backward difference interpolation is convergent of order n if $n\leq6$. Simple numerical results are given. Numerical stability is discussed and a diagram of stability is exhibited. (12 refs.)

Subharmonic capture of aeroelastic self-oscillations of circular cylinder .... See Entry 71436

Numerical calculations of steady three-dimensional turbulent jets in cross flow .... See Entry 71619

A composite model for the conserved scalar PDF [of turbulent reacting flows] .... See Entry 71664

Effect of sedimentation on Taylor diffusion .... See Entry 73375

47.25C Isotropic turbulence

71524 An interaction algorithm for three-dimensional turbulent subsonic aerodynamic juncture region flow. A.J.Baker (Univ. of Tennessee, Knoxville, TN, USA), J.A.Orzechowski.
AIAA J. (USA), vol.21, no.4, p.524-33 (April 1983).
An order-of-magnitude analysis of the subsonic three-dimensional, steady time-averaged Navier-Stokes equations for semibounded aerodynamic junction geometries yields the parabolic Navier-Stokes simplification. The numerical solution of the resultant pressure Poisson equation is cast into complementary and particular parts, yielding an iterative interaction algorithm with an exterior three-dimensional potential flow solution. A parabolic transverse momentum equation set is constructed, wherein robust enforcement of first-order continuity effects is accomplished using a penalty differential constraint concept within a finite-element solution algorithm. A Reynolds stress constitutive equation, with low-turbulence Reynolds number wall functions, is employed for closure, using parabolic forms of the two-equation turbulent kinetic energy-dissipation equation system. The algorithm is employed to predict the three-dimensional turbulent flowfield in the juncture region formed by two intersecting parabolic arcs at $M_{\propto}=0.88$ and $Re/C=0.6\times10^6$/m. Additional results document the turbulence closure model. (31 refs.)

71525 Calculation of turbulent flow of an incompressible fluid in a circular tube with suction through porous walls. V.M.Eroshenko, A.V.Ershov, L.I.Zaichik.
Fluid Dyn. (USA), vol.17, no.4, p.559-64 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.87-93 (July-Aug. 1982). [received: April 1983]
The authors use a three-parameter model of turbulence to calculate turbulent flow in a tube with uniform suction of incompressible fluid through permeable walls. The three-parameter model is based on the balance equations for the turbulence energy, the Reynolds tangential stresses and the dissipative function. (21 refs.)

71526 Calculation of fully developed turbulent flows in ducts of arbitrary cross-section. A.Nakayama, W.L.Chow (Dept. of Mech. & Industrial Engng., Univ. of Illinois, Urbana, IL, USA), D.Sharma.
J. Fluid Mech. (GB), vol.128, p.199-217 (March 1983).
The algebraic stress model developed by Launder and Ying (1973) for the secondary flow of the second kind was employed with the k and ϵ model for the prediction of fully developed turbulent flows in square, rectangular and trapezoidal ducts using the numerical procedure designed for ducts of arbitrary cross-sectional shape. Results of the calculation are compared extensively with available experimental data, with strong emphasis on the local structures of turbulence to reveal full features of this particular stress model. (22 refs.)

71527 The effect of a passive cross-stream temperature gradient on the evolution of temperature variance and heat flux in grid turbulence. A.Sirivat, Z.Warhaft (Sibley School of Mech. & Aerospace Engng., Cornell Univ., Ithaca, NY, USA).
J. Fluid Mech. (GB), vol.128, p.323-46 (March 1983).
The evolution of temperature variance and heat flux in decaying grid turbulence with a linear cross-stream temperature gradient is studied by producing the temperature gradient by means of two different methods: (*a*) by placing a 'mandoline' (Warhaft and Lumley 1978) downstream from the grid but with its wires differentially heated for the present study, and (*b*) by differentially heating ribbons of nichrome (a 'toaster') placed in the plenum chamber of the wind tunnel. For the former method the initial

thermal/mechanical lengthscale ratio L_θ/L was varied by changing the mandoline configuration. For this method it is shown that the gradient causes L_θ/L to equilibrate to a value of about 0.9 regardless of its initial value, and that when this value is achieved the temperature variance increases approximately linearly with time. The toaster was used to produce a temperature gradient without the associated initial temperature variance (and initial thermal lengthscale) that is necessarily produced by the mandoline wires; for the toaster the temperature variance was produced solely by the action of turbulence against the temperature gradient. (15 refs.)

71528 Effect of polymer additives on propagation of turbulence front. V.N.Kalashnikov, V.A.Kalinichenko (Inst. of Problems in Mech., Acad. of Sci., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.862-6 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.220-4 (Aug. 1982). [received: April 1983]
A study is made of the propagation of a turbulent region formed by vibrations of plates with holes in solutions of polyoxyethylene and guar resin. Polymer additives are found to appreciably affect the motion of a turbulence front. (19 refs.)

71529 A group of second-order turbulence models for flow with curved current lines. E.P.Sukhovich.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.84-91 (1983). In Russian.
Five turbulence models with different complexity, based on the transport equations for Reynolds stress tensor and for velocity and temperature pulsation correlations, were developed. The models were derived for the complete second-order turbulence model using some simplifying assumptions. All models contain a common system of empirical coefficients. The group of models presented here is meant for the analysis of complicated turbulent flows. The analysis of applicability of these models to flow with curved current line was performed. Comments are given as to the choice of turbulence models which can be used for description of effects occurring due to strong influence of inertia force field on the turbulence structure. (13 refs.)

Analysis of natural convection using penalty finite elements: laminar flow analysis and turbulent flow analysis by mixing length theory .... See Entry 70644

Charge generation in low dielectric constant liquids .... See Entry 71513

Temporal development of the Taylor vortices in a rotating fluid. V .... See Entry 71571

Experimental investigation of a turbulent jet in turbulent cross flow .... See Entry 71621

Nonlinear stage of the shearing instability in a stratified liquid of finite depth .... See Entry 71626

Experimental study of the drag of a two-phase helium flow in channels .... See Entry 71634

Modeling of mass-exchange processes taking into account fluctuations of the physicochemical parameters .... See Entry 71635

47.25F Boundary layer and shear turbulence

71530 Riblets as a visuous drag reduction technique. M.J.Walsh (NASA, Langley Res. Center, Hampton, VA, USA).
AIAA J. (USA), vol.21, no.4, p.485-6 (April 1983).
The viscous drag of turbulent boundary layers is a significant factor contributing to the fuel costs of the airlines. Several studies have indicated that microsurface geometry variations which change the near-wall structure of the flow have been effective in reducing drag. An investigation into the verification and extension of the most promising of these riblet variations is reported. (4 refs.)

71531 Freestream turbulence effects on attached subsonic turbulent boundary layers. S.Raghunathan, R.J.W.McAdam (Queen's Univ. of Belfast, Belfast, N Ireland).
AIAA J. (USA), vol.21, no.4, p.503-8 (April 1983).
Experimental data on the influence of freestream turbulence in the range 0.3-6% on an attached turbulent boundary layer at zero pressure gradient, at a Mach number of 0.8 and at a momentum thickness Reynolds number of 10^4 are presented. Correlations with the low speed data indicate that there is no influence of Reynolds number on the freestream turbulence/boundary-layer interaction. The skin friction coefficient shows nonlinear effects at low turbulence levels and correlates well with the wall turbulence. The boundary-layer momentum thickness shows an initial increase followed by a decrease in its levels with the increase in turbulence. (12 refs.)

71532 A method of predicting unsteady turbulent flows and its application to diffusers with unsteady inlet conditions. A.A.Lyrio, J.H.Ferziger (Stanford Univ., Stanford, CA, USA).
AIAA J. (USA), vol.21, no.4, p.534-40 (April 1983).
An integral method for computing the main characteristics of unsteady, incompressible, turbulent flows is developed. The method is applied to unsteady boundary layers with a prescribed freestream velocity and to diffusers with unsteady inlet conditions. For prescribed pressure gradient flows, the method gives as good results and is more than an order of magnitude faster than finite difference methods. For diffuser flows, no other methods have been found in the literature. (30 refs.)

71533 Compressible turbulent boundary layer in strong adverse pressure gradient. Dong-ho Lee (Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
AIAA J. (USA), vol.21, no.4, p.632-3 (April 1983).
An experiment of shock wave/turbulent boundary-layer interaction in a supersonic wind tunnel was reported by Ardonceau et al. (1979). This Note summarizes an extensive analysis of the mean data carried out to study the effects of pressure gradient and upstream history on the development of compressible turbulent boundary layer. (11 refs.)

71534 Influence of finite slot size on boundary layer with suction or injection. J.Brandeis (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
AIAA J. (USA), vol.21, no.4, p.636-7 (April 1983).
Suction and injection are two widely used methods for boundary-layer control. In practice, the mass transfer at the wall is accomplished through a number of finite-size holes or slots. The author examines numerically the flowfield within a finite, two-dimensional slot through which fluid can either be added or subtracted from the boundary layer. The results obtained provide a more realistic and accurate description of the velocity distribution at the outlet of a slot. The effects of the size of the slot on the flowfield are noted. (8 refs.)

71535 Nonsimilar boundary layers on the leeside of cones at incidence. T.Cebeci, K.Stewartson, S.N.Brown (Res. Aerodynamics Subdiv., Douglas Aircraft Co., Long Beach, CA, USA).
Comput. & Fluids (GB), vol.11, no.3, p.175-86 (1983).
It is known that the similarity equations for the leeward line of symmetry of a cone have no solutions for $-1<k_2^*<k<k_1^*<0$, where k is the incidence parameter of Moore, and k_1^*, k_2^* depend on the external Mach number and enthalpy ratio. The authors present evidence that a leeside integration for such k terminates at a finite distance from the vertex in a singularity of the type analyzed by Stewartson and Simpson (1982) for entry flow in a curved pipe, and compare the theory with a representative numerical solution at $k=-1/2$. A possible interpretation of this singularity is that the boundary layers growing from the windward line of symmetry have collided, and support for this view is given by windward to leeward integrations for a range of values of k. For k such that the similarity equations have solutions, these are interpreted as limits of more general solutions. (17 refs.)

71536 Slow flow of gas past a strongly heated sphere in the presence of blowing and evaporation from its surface. A.Yu.Boris.
Fluid Dyn. (USA), vol.17, no.4, p.593-8 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.128-34 (July-Aug. 1982). [received: April 1983]
A solution is obtained to the problem of the simultaneous influence of blowing (evaporation) and large temperature differences on the flow past a sphere and on the force acting on it with allowance for the Burnett thermal stresses in the momentum equation. It is assumed that the Reynolds numbers calculated using the blowing velocity and the velocity of the oncoming flow, respectively, have the order $\mathrm{Re}_w \sim 1$ and $\mathrm{Re}_\infty \ll 1$. The temperature difference is determined by the boundary conditions, namely, a constant temperature $\mathrm{T}_w \neq \mathrm{T}_\infty$ on the surface of the sphere ($\nabla \mathrm{T}/\mathrm{T} \sim 1$). The problem is solved by the method of matched asymptotic expansions with respect to the small parameter Re_∞. The equations reduce to a system of ordinary differential equations, which are solved numerically by the orthogonal sweep method. It is found that under certain conditions the drag of the sphere can become negative. (10 refs.)

71537 Flow-acoustic interaction near a flexible wall. A.P.Dowling (Dept. of Engng., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.128, p.181-98 (March 1983).
The Lighthill theory has been extended so that it may be used to determine the flow noise induced by a turbulent boundary layer over a plane homogeneous flexible surface. The influence of the surface properties and the mean flow on the sound generated is brought out explicitly through the use of a Green function. It is found that there is an analogy between the sound generated by turbulence and equivalent sources placed between a surface with the same compliance as the physical surface and a hypothetical vortex sheet positioned at the outer edge of the boundary layer. This analogy is used to determine the spectrum of the surface-pressure fluctuations under statistically stationary turbulence. The form of this wall-pressure spectrum is investigated in detail for three particular types of surface: rigid surfaces, bending plates and sound-absorbent liners. (15 refs.)

71538 On the role of wall-pressure fluctuations in deterministic motions in the turbulent boundary layer. A.S.W.Thomas, M.K.Bull (Dept. of Mech. Engng., Univ. of Adelaide, Adelaide, Australia).
J. Fluid Mech. (GB), vol.128, p.283-322 (March 1983).
The wall-pressure fluctuations beneath a turbulent boundary layer have been conditionally sampled on a basis of the high-frequency activity of the pressure fluctuations themselves, the high-frequency activity of the streamwise velocity fluctuations in the vicinity of the wall, and the excursions in velocity in the vicinity of the wall. This has led to the identification of a characteristic wall-pressure fluctuation pattern which is associated with the burst-sweep cycle of events in the wall region. The pattern has the form of an overpressure over a streamwise extent of about 1.5-2.0 δ_*, with a region of underpressure and a pressure minimum to either side of it, the distance between pressure minima being about 3.0-3.5 δ_*. This pattern is convected at a velocity 0.67 times the freestream velocity. Its phase relationship with velocity fluctuations close to the wall and the wall shear-stress fluctuations during the burst-sweep cycle have been established. It appears to be produced by the inclined shear layer which forms the upstream surface of the large organized structures in the layer, and calculated pressure patterns support this conclusion. (40 refs.)

71539 Some aspects of fluctuating vertical wind shears. J.C.Doran (Pacific Northwest Lab., Richland, WA, USA).
Sol. Energy (USA), vol.30, no.5, p.473-9 (1983).
Fluctuating vertical shears of wind speed have been measured using anemometers on an array of towers. The statistical distributions of these shears are compared with formulas proposed by Fichtl and good agreement is found. A comparison of Fichtl's formula for $\sigma_{\Delta u}$, the standard deviation of the fluctuating shears, with a more empirical one proposed by Ramsdell shows that the latter is consistent with the former under the proper conditions. The probability of occurrence of extreme shears in speed is discussed. Fluctuating shears two or more times larger than the mean values are shown to occur frequently, and their likelihood increases as the mean measuring height increases if Δz is held fixed. These results are applicable for slightly unstable to neutral conditions over level, homogeneous terrain, and in the surface boundary layers. The normal distribution gives a useful lower bound on shear values. Probabilities of extreme shears as a function of $\Delta z/\bar{z}$ are given. $\sigma_{\Delta u}$ is also shown to be affected by τ, the averaging time used for the shear measurements. Increasing τ from 0.2 to 4 sec can decrease σ_Δ by 25 per cent or more. The effects of τ on the probability of extreme events is shown. (6 refs.)

Investigation of the influence of the unit Reynolds number of the transition of a boundary layer on a sharp cone .... See Entry 71514

Influence of the angle of attack on the transition from a laminar to a turbulent boundary layer in the case of supersonic flow past sharp circular cones .... See Entry 71515

An interaction algorithm for three-dimensional turbulent subsonic aerodynamic juncture region flow .... See Entry 71524

The low wavenumber wall pressure spectrum on a flexible surface .... See Entry 71540

Prediction of rough-wall skin friction and heat transfer .... See Entry 71541

Effects of variable fluid properties and boundary conditions on thermal convection .... See Entry 71544

Heat transfer in micropolar boundary layer flow over a flat plate .... See Entry 71550

Free-convection heat transfer on a vertical surface with a temperature discontinuity .... See Entry 71553

Numerical study of incompressible flow about immersed elastic boundaries .... See Entry 71563

Long eddies in sheared flows ....See Entry 71587
Wall pressure fluctuations in attached boundary-layer flow .....See Entry 71594
Secondary instability of wall-bounded shear flows ....See Entry 71652

47.25M Noise (turbulence generated)

71540 The low wavenumber wall pressure spectrum on a flexible surface. A.P.Dowling (Engng. Dept., Cambridge Univ., Cambridge, England).
J. Sound & Vib. (GB), vol.88, no.1, p.11-25 (8 May 1983).
The Lighthill theory (1952) has been extended so that it may be used to determine the flow noise induced by a turbulent boundary layer over a flexible surface. The theory brings out explicitly the effects of the surface properties. The surface pressure spectrum has been investigated in detail for a bending plate, and the effects of surface dissipation and a coating layer have been determined. It is found that damping in the plate or some coating layers can have a beneficial effect and reduce certain spectral components of the flow noise. However, coatings with a low sound speed are found to have an adverse effect on the flow noise. (12 refs.)

Flow-acoustic interaction near a flexible wall ....See Entry 71537
The velocity perturbations above the orifice of an acoustically excited cavity in grazing flow ....See Entry 71567
A finite element approach for predicting nozzle admittances ...See Entry 71625
Regulating valves: the noise problem. I .... See Entry 71646

47.25Q Convection and heat transfer

(see also 44.25 Convective and constrained heat transfer)

71541 Prediction of rough-wall skin friction and heat transfer. G.H.Christoph, (Sci. Applications Inc., Wayne, PA, USA), R.H.Pletcher.
AIAA J. (USA), vol.21, no.4, p.509-15 (April 1983).
A finite difference solution to the boundary-layer equations for flow over rough surfaces is presented. The boundary-layer equations are cast in a form to account for the blockage effects of roughness elements. The roughness effect is described by a sink term in the momentum equation and a source term in the static enthalpy equation. A two-layer algebraic mixing length model that accounts for low Reynolds numbers, surface roughness, and wall transpiration is developed. Good agreement is shown for several comparisons to roughwall, flat-plate and sharp-cone data. (25 refs.)

71542 Theoretical study on the development of the axially symmetric thermal plume: influence of thermophysical properties of the fluid. B.Guillou, D.-K.Son (Lab. de Thermique, ENSMA, CNRS, Poitiers, France).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.101-9 (March-April 1983). In French.
The influence of the variations of the physical properties with temperature on the structure of thermal plumes in air is numerically determined. It is for that purpose that the evolution of the initial theoretical profiles is studied in the case of constant properties (giving self-preserving solutions) and in the case of variable properties. The development of the flow in these two cases is found to be significantly different. Moreover, the comparison with numerical calculations and the authors' laboratory's experiment is satisfactory. (8 refs.)

71543 Mass transfer and free convection through a porous medium by the presence of a rotating fluid. A.Raptis (Dept. of Mech., Univ. of Ioannina, Ioannina, Greece).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.141-6 (March-April 1983).
Steady free convection and mass transfer through a porous medium bounded by an infinite vertical porous plate is considered for a fluid rotating with a constant angular velocity when the heat flux at the plate is constant. The influence of the various parameters entering into the problem on the velocity field is discussed. (5 refs.)

71544 Effects of variable fluid properties and boundary conditions on thermal convection. A.Cordoba (Dept. de Termologia, Univ. de Sevilla, Sevilla, Spain).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.147-51 (March-April 1983).
The onset of convection in a fluid layer heated from below is considered. The fluid properties are allowed to vary with temperature according to a linear relation. The fluid layer is bounded by two horizontal rigid plates, and the lower boundary is considered a perfect thermal conductor whereas the upper one is taken with a finite thermal conductivity. With these asymmetric boundary conditions linear variations in density, thermal conductivity and specific heat yield first-order corrections to the critical value of the Rayleigh number whereas linear variations in viscosity and thermal expansion coefficient give rise to second-order corrections to the critical Rayleigh number. The greatest effect is due to thermal conductivity variation. When the boundary conditions are symmetric the corrections are second-order. (11 refs.)

71545 Unsteady Couette flow and heat transfer in a dusty gas. N.Datta, S.K.Mishra (Dept. of Maths., Indian Inst. of Technol., Kharagpur, India).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.153-62 (March-April 1983).
Unsteady flow of a dusty fluid, filling the gap between two infinite parallel plates kept at arbitrary temperatures, has been considered. The flow is induced by the impulsive start of one of the plates. The number density of the particles has been considered to be uniform throughout the motion and the solution for any time has been obtained by using Laplace transform followed by its numerical inversion. It has been observed that initially there is oscillation in both the fluid velocity and temperature distribution. Also the particles slip on the moving plate at the initial stage. Further Nusselt number increases with the increase of the concentration parameter. (3 refs.)

71546 Calculation of unsteady natural concentration convection in binary mixtures of gases with arbitrary ratio of their densities. D.A.Nikulin, M.Kh.Strelets.
Fluid Dyn. (USA), vol.17, no.4, p.509-13 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.27-31 (July-Aug. 1982). [received: April 1983]
The approximate system of equations formulated by Nikulin, Potekhin, and Strelets (1980) can, in contrast to the system in the Boussinesq approximation, be used to describe natural concentration convection in the presence of significant changes in the composition in gas mixtures with arbitrary ratio of the molecular weights of the components. The possibilities opened up by the use of this system of equations are illustrated by the example of a numerical investigation of unsteady free convection of an isothermal binary gas mixture in a closed rectangular region in a wide range of variation of the Archimedes number and the ratio of the molecular weights of the components of the mixture. (8 refs.)

71547 Vibrational thermal convection in a rectangular cavity. G.Z.Gershuni, E.M.Zhukhovitskii, Yu.S.Yurkov.
Fluid Dyn. (USA), vol.17, no.4, p.565-9 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.94-9 (July-Aug. 1982). [received: April 1983]
Vibrational thermal convection in a rectangular cavity under conditions of weightlessness is studied. A numerical investigation is made of the developed vibrational convection which arises under conditions when equilibrium is impossible. The structure of the average vibrational-convective flows and the characteristics of the heat transfer are determined. The change of regimes and the connection with the stability problem are discussed. (6 refs.)

71548 Investigation of flow past blunt bodies with allowance for radiation by the large-particle method. O.M.Belotserkovskii, Yu.M.Davydov, V.P.Skotnikov, V.N.Fomin.
Fluid Dyn. (USA), vol.17, no.4, p.574-9 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.106-12 (July-Aug. 1982). [received: April 1983]
The large-particle method as developed by Belotserkovskii and Davydov (1971) is developed to calculate hypersonic flows with radiation around blunt bodies, including the case when there is distributed blowing from the surface of the bodies into the shock layer, which stimulates ablation of a heat-shielding covering under the influence of strong heating by radiation. The results are given of systematic calculations of flow past blunt bodies of various shapes by a stream of radiating air, and the results are compared with the data of other methods. (17 refs.)

71549 Natural convection produced by unsteady heating of a viscoplastic liquid in a plane vertical layer. S.G.Cherkasov.
Fluid Dyn. (USA), vol.17, no.4, p.610-12 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.148-50 (July-Aug. 1982). [received: April 1983]
A study is made of the unsteady heating of a viscoplastic liquid in the space between two infinite vertical plates when one is thermally insulated and a constant, uniformly distributed heat flux is supplied to the other after a certain initial time. It is assumed that at the initial time the liquid is uniformly heated. (5 refs.)

71550 Heat transfer in micropolar boundary layer flow over a flat plate. R.S.R.Gorla, R.Pender, J.Eppich (Dept. of Mech. Engng., Cleveland State Univ., Cleveland, OH, USA).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.791-8 (1983).
Boundary layer solutions are presented to study the steady state heat transfer from a semi-infinite flat plate to a micropolar fluid. The boundary conditions of isothermal wall, constant surface heat flux and insulated wall with viscous dissipation effects have been treated. Numerical results for the temperature distribution and the missing wall values of the thermal functions have been given. The range of Prandtl numbers investigated was from 10 to 1000 while the dimensionless grouping of the material properties was allowed to vary over a wide range. (5 refs.)

71551 The dynamics of double-diffusive gravity currents. T.Maxworthy (Dept. of Mech. Engng., Univ. of Southern California, Los Angeles, CA, USA).
J. Fluid Mech. (GB), vol.128, p.259-82 (March 1983).
Gravity currents or intrusions for which the fluid within the current contains a substance that gives it a diffusivity different from that of its surroundings are very common both in natural and technological applications. The interface between the two fluids can become the site of either a 'fingering' or a 'diffusive' type of instability, and vigorous convection and material exchange occurs (Turner 1975). This transfer of material has several important effects upon the dynamics of the intrusion. Horizontal momentum can be transferred across the interface to create a stress which in many cases dominates the more conventional viscous stresses. Entrainment into the convective plume beneath the intrusion and, in a container of finite depth, the formation of a secondary, bottom-boundary current, creates a flow external to the main intrusion which modifies its behaviour even more. Two cases have been studied: the release of a fixed volume of fluid and the injection of fluid at a constant rate for both types of interface. Several experiments on the motion of an intrusion for which the interface is essentially non-diffusive are presented for comparison. (17 refs.)

71552 Natural convection heat transfer in air about a horizontal circular nonisothermal cylinder. V.N.Pustovalov, Yu.Ya.Matveev (V.I. Lenin Kharkov Polytech. Inst., Kharkov, Ukrainian SSR).
J. Eng. Phys. (USA), vol.43, no.2, p.853-8 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.209-15 (Aug. 1982). [received: April 1983]
Results are presentd of a numerical investigation of laminar free convection heat transfer in air about a horizontal circular cylinder in the moderate Grashoff number range ($10^4 \leq Gr_m \leq 10^9$), for linear and quadratic laws of surface temperature variation. (10 refs.)

71553 Free-convection heat transfer on a vertical surface with a temperature discontinuity. Yu.A.Sokovishin, L.A.Erman (M.I. Kalinin Leningrad Polytech. Inst., Leningrad, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.858-61 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.216-20 (Aug. 1982). [received: April 1983]
Parametric correlations are obtained for calculating heat transfer on a vertical surface with a temperature discontinuity, over a wide range of variation of Prandtl number and for calculating the relations of temperatures at the wall. (9 refs.)

71554 Heat transfer in the nonisothermal flow of an anomalously viscous fluid in a helical duct. A.I.Mumladze, Yu.G.Nazmeev, O.V.Maminov (S.M. Kirov Chem.-Technol. Inst., Kazan, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.869-74 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.228-34 (Aug. 1982). [received: April 1983]
The problem of heat transfer in the initial section of a helical duct with a steady flow of an anomalously viscous fluid is solved numerically. The authors solve the heat-transfer problem of a duct formed by an internal continuous helicoid vane fitted tightly to the inside wall of the pipe for steady laminar flow of an anomalously viscous temperature-dependent fluid under the condition of dissipative heat loss and Dirichlet-type boundary conditions. (5 refs.)

71555 Theoretical analysis of heat transfer in zone-melting operation. S.Mori (Dept. of Chem. Engng., Kanazawa, Japan), J.Tsuchida, A.Kikuchi, A.Tanimoto.
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.1-12 (Nov. 1982). In Japanese.
The heat conduction in an infinite slab of finite thickness accompanied by a heat source moving at constant speed, was analyzed theoretically. The heat source is specified as either internal heat generation in the slab or external heating at constant flux. The effect of phase change was assumed to be

negligible and physical properties were also assumed to be constant. Through results calculated, the influence of source velocity on shapes and positions of melting and freezing interfaces was found to be important. Moving the heat source tends to make the freezing front more concave in shape. Based on the shape of the growing interface and the temperature gradient near the interface, the optimum operating conditions for zone melting were discussed. (9 refs.)

71556 Examination of the formation of finite disturbances in the course of the convection of a viscoelastic liquid within a horizontal layer. F.A.Gariffullin, F.C.Tasjukow, E.-O.Reher.
Plaste & Kautsch. (Germany), vol.30, no.3, p.157-60 (March 1983). In German.
The investigation of disturbance propagation has great significance for quantifying convective heat transport. The formation of convective laminar vortices in horizontal layers of viscoelastic liquids is discussed from a theoretical viewpoint, with the development of equations. Experimental work has shown that, e.g., non-Newtonian viscoelastic liquids such as polyethylene oxide aqueous solution exhibit a 'hard' instability, leading to the conclusion that the rheological properties of polymer solutions influence the formation and development of the convective process. (6 refs.) *A.E.W.*

71557 Transient thermal Marangoni convection in a liquid bridge [floating zone techniques, near zero gravity]. H.F.Bauer (Hochschule der Bundeswehr Munchen, Fachbereich Luft- und Raumfahrttech., Neubiberg, Germany).
Z. Flugwiss. & Weltraumforsch. (Germany), vol.7, no.2, p.120-33 (March-April 1983). In German.
By a sudden change of an imposed axial temperature field at the liquid surface of an infinite cylindrical liquid bridge, a transient convection is initiated inside the liquid. This is due to the sudden change in surface tension causing a transient flow from an original velocity distribution to a final one by means of the thermal Marangoni effect. This transient has been determined analytically for linear, quadratic, sinusoidal and exponential axial temperature fields. Some special cases have been evaluated numerically. It should be noted that the method presented may also be used if any periodic axial temperature distribution is suddenly changed into any other periodic temperature field. It is also valid for time-periodic temperature fields. (28 refs.)

71558 The onset of chaos in convecting fluids. P.C.Martin (Phys. Dept. & Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.179-94
The fluid systems that have been most carefully and extensively studied over the past years, that often exhibit some features of simple mathematical models, and that, in a few cases, show quantitative similarities, are systems in circular Couette flow and systems undergoing Rayleigh-Benard convection. Before discussing a few features of the mathematical models, the author points out some of the complications that occur in real convecting systems, and briefly reviews some recent progress in sorting them out. The degree to which these complications are an essential part of observed turbulent phenomena is still unclear, as is the relevance of the various mathematical models with which the author hopes to model and predict quantitatively the behavior of suitably prepared real fluid systems. Many carefully measured properties of the fluids have yet to be explained by the models, and while it is not difficult to construct simple mechanical systems or analog computers that behave like the mathematical models, in almost every real fluid system some 'messy detail' that the models omit, seems to matter. (46 refs.)

Heat transfer in the last decade .... See Entry 69848

Analysis of natural convection using penalty finite elements: laminar flow analysis and turbulent flow analysis by mixing length theory .... See Entry 70644

Thermal homogeneity in a closed excimer laser cavity .... See Entry 71109

Finite difference calculations of buoyant convection in an enclosure. I. The basic algorithm .... See Entry 71333

A comparison on the stability of horizontal fluid layers with radiative heat generation for two and three porous plates .... See Entry 71340

The effect of a passive cross-stream temperature gradient on the evolution of temperature variance and heat flux in grid turbulence .... See Entry 71527

Motion of a drop with allowance for thermocapillary forces ... See Entry 71615

Convective instability of a homogeneous fluidized bed .... See Entry 71638

The boundary correction for the Rayleigh-Darcy problem: limitations of the Brinkman equation .... See Entry 71642

The hydraulic resistance of a horizontal rectangular channel with stratified two-phase flow .... See Entry 71656

Instability of horizontal fluid interface in a perpendicular electric field: observational study .... See Entry 71658

Hydrodynamics of films of surface-active substances .... See Entry 71665

The induction period of a thermal explosion in a gas between infinite parallel plates .... See Entry 73336

Comments on paper [simple multiple wick solar still: analysis and performance] .... See Entry 73419

A two-pass solar air heater .... See Entry 73471

47.25R Wakes

71559 The effects of yaw and finite length upon the vortex wakes of stationary and vibrating circular cylinders. S.E.Ramberg (Div. of Marine Technol., Naval Res. Lab., Washington, DC, USA).
J. Fluid Mech. (GB), vol.128, p.81-107 (March 1983).
Considers the vortex wakes behind finite-length yawed cylinders that are stationary or vibrating transversely in a uniform flow. In the Reynolds-number range 160-10^3 a number of three-dimensional and nominally two-dimensional wake flows are observed and attributed to the dominance of end conditions over rather large spans of the cylinder (aspect ratios up to 100). (29 refs.)

71560 Interference between two circular cylinders forming a cross. M.M.Zdravkovich (Univ. of Salford, Salford, England).
J. Fluid Mech. (GB), vol.128, p.231-46 (March 1983).
The interference of flow around two circular cylinders forming a cross can be considered as an element of a gauze screen or an offshore structure. The most important feature of the interference was found to be a significant increase of local drag coefficient due to the symmetric formation of secondary flow patterns. The pressure distribution measured around both cylinders at various spanwise stations was distinctly different for the two cylinders in the region of interference. A strong secondary flow was found behind the upstream cylinder and in front of the downstream cylinder. The secondary flow distorted and displaced the separation streamlines on the upstream and downstream cylinders. This has been verified by oil-film flow visualization. (13 refs.)

A higher order panel method applied to vortex sheet roll-up ... See Entry 71561

47.30 ROTATIONAL FLOW AND VORTICITY

71561 A higher order panel method applied to vortex sheet roll-up. H.W.M.Hoeijmakers, W.Vaatstra (Nat. Aerospace Lab., NLR, Amsterdam, Netherlands).
AIAA J. (USA), vol.21, no.4, p.516-23 (April 1983).
Describes a computational method for two-dimensional vortex sheet motion in incompressible flow. The procedure utilizes a second-order panel method, an adaptive panel scheme, and a concept for treating highly rolled-up portions of the vortex sheet. Results are presented for the roll-up of the wake behind an elliptically loaded wing, a ring (nacelle), a fuselage/part-span flap/wing combination, and a delta wing with leading-edge vortex sheets. The examples demonstrate that the method is capable of describing complicated vortex sheet motion in a reliable and stable manner. (26 refs.)

71562 On the completeness of Trkalian motions of Navier-Stokes fluids. A.W.Marris (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
Arch. Ration. Mech. & Anal. (Germany), vol.82, no.2, p.117-64 (1983).
In an earlier paper (1979) the author showed that no steady rotational screw motions of Navier-Stokes fluids exist. However, there is a class of screw motions of Navier-Stokes fluids, which are unsteady motions with steady stream lines. Consider the class of screw motions in which the abnormality π_{11} is spatially constant. These motions, known as Trkalian motions, have been the subject of a treatise by Bjorgum & Godal (1952). For a Trkalian motion to be a possible motion of a Navier Stokes fluid the abnormality π_{11} must also be temporally constant and that the velocity field is given by $v=e(-\nu\pi_{11}{}^2t)u$, where u is any steady Trkalian field of abnormality π_{11}. The equation defines a motion whose stream lines are steady but whose velocity magnitude decays exponentially with time. Motions with steady stream lines have some of the physical significance of steady motions. It seems natural to ask, are Trkalian motions the only rotational screw motions of Navier-Stokes fluids for which the stream lines are steady? The author shows that the answer is yes. (5 refs.)

71563 Numerical study of incompressible flow about immersed elastic boundaries. R.Mendez (Naval Postgraduate School, Monterey, CA, USA).
SIAM J. Sci. & Stat. Comput. (USA), vol.4, no.1, p.94-104 (March 1983).
The interaction between a two-dimensional, incompressible inviscid fluid and a one-dimensional tense elastic boundary is studied. The boundary exerts forces on the fluid but its motion is determined from the motion of the fluid. The crux of the method lies in the representation of the point-forces into which the boundary stresses are discretised using Peskin's link formalism via a collection of vortex pairs of appropriate opposite strengths (vortex dipoles). Euler's equations are then integrated; the vorticity at the boundary determines the fluid motion everywhere. The method is applied to follow the oscillatory motion of an immersed tense circular boundary which at $t=0$ has been deformed into an ellipse. (8 refs.)

71564 Flow near a vibrating cylinder. E.D.Sorokodum.
Fluid Dyn. (USA), vol.17, no.4, p.654-6 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.190-2 (July-Aug. 1982). [received: April 1983]
The results are given of experimental investigations into the change in the structure of the secondary steady flows near a circular cylinder vibrating in a fluid at rest in the direction perpendicular to its axis in a wide range of vibration amplitudes at high Reynolds numbers. For vibration amplitudes less than the cylinder diameter, not only viscous waves but also four vortices are generated near the surface of the cylinder and four steady flows at some distance from it. During a period of the vibration, the vortices near the cylinder change their shape and position. At vibration amplitudes comparable with the cylinder diameter, the vortices become separated and form two vortex streets. If the vibration amplitude is increased further, the streets bifurcate. (5 refs.)

71565 Analysis of torsional potential streams. V.K.Kostin, V.I.Epifanova.
Izv. VUZ Mashinostr. (USSR), no.3, p.71-5 (1983). In Russian.
Reports the results of a theoretical analysis of the motion of torsional, radially-balanced streams of inviscid barotropic fluid within the potential motion model. The motion of a torsional stream in a vortical device with an isoentropic diffuser is discussed and a dependence derived between stream parameters and the geometric characteristics of the vortical device. A general solution is presented for the motion of a torsional stream in the vortical device with an isoentropic diffuser. The results for the torsional stream are given for the case of diffuser-free vortical device, and for a device with an isoentropic diffuser. The possibility of generation of shock waves in the stream is discussed and the bounds for shock-free motion of the barotropic fluid are established. (6 refs.) *Z.F.V.*

71566 The flow between two finite rotating disks enclosed by a cylinder. D.Dijkstra, G.J.F.van Heijst (Dept. of Appl. Math., Twente Univ. of Technol., Enschede, Netherlands).
J. Fluid Mech. (GB), vol.128, p.123-54 (March 1983).
The flow between two finite rotating disks enclosed by a cylinder is investigated both numerically and experimentally. For this finite geometry the full stationary Navier-Stokes equations are solved numerically without similarity assumptions. Experimental results are obtained by means of stereophotography of small tracer particles. The results are in good agreement with the numerical solution. Owing to the presence of the cylinder sidewall, the solution is found to be unique for all values of the parameters considered. When the disks rotate in opposite senses with counter-rotation above 15%, a stagnation point appears at the slower-rotating disk. This stagnation point is associated with a two-cell structure in the meridional plane and is experimentally observed as a ring of particles at the slower-rotating disk. Near the axis of rotation the solution is found to satisfy similarity demands; for weak counter-rotation the solution is of Batchelor type near the axis of rotation, but for strong counter-rotation a Stewartson profile is found to be more adequate for the description of the tangential velocity near the axis. (16 refs.)

71567 The velocity perturbations above the orifice of an acoustically excited cavity in grazing flow. A.F.Charwat, B.E.Walker (Dept. of Mech. & Structures, Univ. of California, Los Angeles, CA, USA).
J. Fluid Mech. (GB), vol.128, p.413-26 (March 1983).
Detailed measurements of the time-dependent velocities induced inside and outside the opening of an acoustically excited, two-dimensional Helmholtz resonator imbedded in a grazing flow are presented. The remarkably clear structure of the perturbation field which evokes a pulsating source and a coherently pulsating vortex-image pair is described. (11 refs.)

71568 Coaxial-disk flow and flow about a rotating disk of a Maxwellian fluid. N.Phan-Thien (Dept. of Mech. Engng., Univ. of Sydney, Sydney, NSW, Australia).
J. Fluid Mech. (GB), vol.128, p.427-42 (March 1983).
The flows of a Maxwellian fluid between two rotating coaxial disks and about a rotating disk are discussed. Asymptotic solutions are derived and numerical solutions are reported for a Weissenberg number up to 10 and a Reynolds number of up to 50. The solutions show transverse wave propagation. Also, at low Weissenberg number the moment coefficient for a rotating disk wetted on both sides is inversely proportional to the square root of the angular velocity of the disk. At high Weissenberg number it is inversely proportional to the angular velocity of the disk. The transition occurs at a Weissenberg number of unity. (20 refs.)

71569 Experimental study of mass exchange in axisymmetric cavities. V.V.Degtyareva, V.A.Mukhin, V.E.Nakoryakov (Inst. of Thermophys., Acad. of Sci., Novosibirsk, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.829-33 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.181-6 (Aug. 1982). [received: April 1983]
Results are presented from a study of mass exchange between the walls in axisymmetric cavities of different configuration and a fluid flow within the cavity. Measurements were made by the electrodiffusion method. The test results are generalized using an empirical relation. (7 refs.)

71570 Transient processes in shear flows of a viscoelastic fluid. III. Elastic recovery. Z.F.Shul'man, S.M.Aleinikov, B.M.Khusid (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.2, p.874-8 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.234-8 (Aug. 1982). [received: April 1983]
For pt.II see Inzh.-Fiz. Zh., vol.42, no.6, p.992 (1982). The authors investigate the transient process associated with the shear flow of a viscoelastic fluid in the clearance space between coaxial cylinders when the outer cylinder is rigidly fixed and the inner one set in motion of the action of a constant external torque. The applied torque acts for a period of time t*, after which it is removed. A mathematical description of the elastic recovery effect associated with viscoelastic shear flow is given. (2 refs.)

71571 Temporal development of the Taylor vortices in a rotating fluid. V. H.Yahata (Dept. of Materials Sci., Hiroshima Univ., Hiroshima, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.396-402 (Feb. 1983).
For pt.IV see ibid., vol.66, p.879 (1981). Transition to turbulence in the Taylor vortex flow between two concentric cylinders is investigated by the use of the 56-mode model equations presented by the author in pt.IV. With the increase of the Reynolds number just before the onset of turbulence, the motion changes as follows: Quasi-periodic motion with three fundamental frequencies to synchronized motion with two frequencies to non-periodic motion. (8 refs.)

71572 Experiments on wave number selection in rotating Couette-Taylor flow. D.S.Cannell, M.A.Dominguez-Lerma, G.Ahlers (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1365-8 (2 May 1983).
Experimental results are reported for the selection of axial wavelengths of Taylor vortices in a system where the Reynolds number, R, is 'ramped' spatially from above to below the critical value, R_c, for the onset of vortex flow. It is found that a sufficiently slow ramp connecting the supercritical region (containing vortices) to a subcritical region (of purely azimuthal flow) results in the selection of a unique wavelength. A more rapid ramp results in a small R-dependent band of allowed wavelengths which grows in width as $R \rightarrow R_c$ from above. (18 refs.)

71573 Vortex-front propagation in rotating Couette-Taylor flow. G.Ahlers, D.S.Cannell (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1583-6 (16 May 1983).
This Letter reports experimental measurements of the velocity v of a Taylor vortex front propagating into an unstable Couette state in rotating Couette-Taylor flow and of the wavelength selected by this dynamical process. The data are consistent with a constant velocity $v \propto \epsilon^{1/2}$, as predicted from an amplitude equation, but are nearly a factor of 2 smaller than that prediction. Recent dynamic experiments on the onset of Taylor vortex flow by Park, Crawford, and Donnelly (1981) are explained in terms of vortex-front propagation. (13 refs.)

71574 Couette flow in continuum to the free molecular regime. K.Nanbu (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan).
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.199-223 (1983).
By use of the direct-simulation method of Nanbu (1980), the Couette flow for wall Mach number 3 is analysed over the whole range of the Knudsen number. The gas is a monotonic one of Maxwell molecules. By comparing the numerical solution obtained from simulation calculations with the approximate six-moment solution of Liu and Lees (1961), the accuracy of the latter is examined in detail. As to the flow velocity and shearing stress, the six-moment solution shows reasonable agreement with the simulation solution. As to the temperature, density, and heat flux, the error of the six-moment solution is not small in all flow regimes except near-continuum one. As to the pressure, it is not uniform in the transition regime differently from the prediction of the six-moment solution. (23 refs.)

Flow-acoustic interaction near a flexible wall ....See Entry 71537

Mass transfer and free convection through a porous medium by the presence of a rotating fluid ....See Entry 71543

Examination of the formation of finite disturbances in the course of the convection of a viscoelastic liquid within a horizontal layer ....See Entry 71556

The onset of chaos in convecting fluids ....See Entry 71558

The effects of yaw and finite length upon the vortex wakes of stationary and vibrating circular cylinders ....See Entry 71559

Interference between two circular cylinders forming a cross ...See Entry 71560

Potential function and problems of oscillations of an exponentially stratified liquid ....See Entry 71575

Normal oscillations of an ideal compressible liquid in rotating elastic vessels ....See Entry 71576

Long eddies in sheared flows ....See Entry 71587

Equilibrium shapes and stability of rotating drops ....See Entry 71614

Cavitation aspects in a Venturi ('Johnsson effects' in a low turbulence flow) ....See Entry 71617

Vorticity of the velocity field for flow in a porous medium with random inhomogeneities ....See Entry 71640

Secondary instability of wall-bounded shear flows ....See Entry 71652

Hydromagnetic waves in a differentially rotating sphere ....See Entry 73720

The stabilizing role of differential rotation on hydromagnetic waves ....See Entry 73721

47.35 WAVES

71575 Potential function and problems of oscillations of an exponentially stratified liquid. S.A.Gabov, K.S.Mamedov.
Dokl. Akad. Nauk SSSR, vol.269, no.2, p.270-3 (1983). In Russian.
The results reported relate to the representation of the solutions to the system of equations for the dynamics of a stratified liquid, and to the reduction of this system to one differential equation, closely analogous to S.L. Sobolev's equation for a rotating liquid. (7 refs.) *F.Q.*

71576 Normal oscillations of an ideal compressible liquid in rotating elastic vessels. A.Garadzhaev.
Dokl. Akad. Nauk SSSR, vol.269, no.2, p.273-8 (1983). In Russian.
A study is reported of the spectra of oscillations of an ideal compressible liquid in rotating vessels. Cases are found where the vessel, filled with liquid, behaves like a rigid body, an elastic body or an elastic shell. (14 refs.) *F.Q.*

71577 Influence of liquid viscosity and Coriolis force on the stability of internal waves. S.M.Khartiev, L.V.Cherkesov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.3, p.60-3 (1983). In Ukrainian.
Sufficient stability criteria are obtained for internal waves taking into account the Coriolis force, velocity shear of flows, fluid viscosity and stratification. (4 refs.)

71578 Nonlinear capillary waves in thin films of viscous liquid and breaking of the films. O.V.Voinov.
Fluid Dyn. (USA), vol.17, no.4, p.526-33 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.47-55 (July-Aug. 1982). [received: April 1983]
A study is made of the dynamics of a thin film of viscous liquid with allowance for the influence of capillary forces and long-range van der Waals forces. Asymptotic solutions are found to problems of the dynamics of films in communication with a region of reduced pressure. It is shown that at a certain instant such a film breaks at its edge. The critical parameters that determine the instant of breaking are found and the form of the solution in the stage of breaking is given. (8 refs.)

71579 Influence of an underwater ridge on a nonlinear wave expanding from a point on the surface of a liquid. A.G.Kulikovskii.
Fluid Dyn. (USA), vol.17, no.4, p.569-73 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.100-5 (July-Aug. 1982). [received: April 1983]
A study is made of the influence of an underwater ridge on a solitary wave that prior to the interaction with the ridge has the form of a circle situated outside the ridge. It is shown that the nonlinear effects lead to a concentration of the wave energy above the ridge. As they move away from the source, the waves propagating above the ridge are not damped in the considered approximation but are damped everywhere away from the ridge. An analogy is pointed out between the propagation of the wave and two-dimensional steady flows of a fluid, and this makes it possible to use hydrodynamic intuition for qualitative predictions about the nature of the wave propagation in various cases. All the results of the paper can be extended to the case of waves that are periodic in time. (4 refs.)

71580 The entry of a falling film into a pool and the air-entrainment problem. S.D.R.Wilson, A.F.Jones (Dept. of Math., Manchester Univ., Manchester, England).
J. Fluid Mech. (GB), vol.128, p.219-30 (March 1983).
When a film of liquid runs down a vertical wall and enters a large pool a number of stationary horizontal ripples are observed on the film just above the point of entry. These ripples are explained and analysed by the method of matched expansions and the results have a bearing on more-complicated problems. Next the case when the wall itself is moving vertically downwards is analysed. This is of interest in roll-coating technology, where it is normally desired to achieve smooth entry of the descending film, without air entrainment. The paper gives sufficient conditions for smooth entry, and these are consistent with known experimental results. (8 refs.)

71581 Gravity currents with variable inflow. T.Maxworthy (Inst. fur Hydromech., Univ. Karlsruhe, Karlsruhe, Germany).
J. Fluid Mech. (GB), vol.128, p.247-57 (March 1983).
The authors have performed a series of experiments on two-dimensional gravity currents for which the inflow rate at the origin is a power-law function of time, $t^{\alpha-1}$. The theoretical results of Huppert (1982), for currents in which there is a balance between buoyancy and viscous forces, are found to be valid for a wide range of conditions. A large number of experiments at a critical value of $\alpha = {}^7/_4$ show very precise agreement with the theory, while values of a parameter that separates regions in which either viscous forces or inertial forces dominate are well within limits one would expect from the order-of-magnitude arguments used. (5 refs.)

71582 A ring-source/integral-equation method for the calculation of hydrodynamic forces exerted on floating bodies of revolution. A.Hulme (Dept. of Math., Univ. of Manchester, Manchester, England).
J. Fluid Mech. (GB), vol.128, p.387-412 (March 1983).
The wave forces exerted on a floating 3-dimensional body can be found by expressing the velocity potential of the surrounding fluid as the field of a distribution of point wave sources over the wetted part of the body surface. The problem then reduces to one of finding the solution to a 2-dimensional Fredholm integral equation of the second kind, to give the (unknown) surface source density. A simplification is possible for bodies that have a vertical axis of symmetry: for this type of body the author can distribute 'rings of sources' over the body surface, and the problem then reduces to the solution of 1-dimensional Fredholm equations of the second kind. This approach has been adopted before, but earlier work has made use of expressions for the fundamental ring-source potentials which are not always suitable for numerical computation. It is possible to derive many alternative expressions for the ring-source potentials, but it appears that no single expression is computationally convenient in every situation; the author discusses the computational merits of three different types of expression, the aim being to provide a comprehensive scheme for the evaluation of the ring-source potentials. The ring-source/integral-equation method is used to calculate the wave forces exerted on certain specific bodies of revolution and results are presented here. A brief discussion of the problem of 'irregular values' is also given: these only occur when the body intersects the free surface. (28 refs.)

71583 Wave modulation and breakdown. W.K.Melville (R.M. Parsons Lab., MIT, Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.128, p.489-506 (March 1983).
Time series of amplitude, frequency, wavenumber and phase speed are measured in an unstable deep-water wavetrain using a Hilbert-transform technique. The modulation variables evolve from sinusoidal perturbations that are well described as slowly varying Stokes waves, through increasingly asymmetric modulations that finally result in very rapid jumps or 'phase reversals'. These anomalies appear to correspond to the 'crest pairing' described by Ramamonjiarisoa and Mollo-Christensen (1979). The measurements offer a novel local description of the instability of deep-water waves which contrasts markedly with the description afforded by conventional Fourier decomposition. The measurements display very large local modulations in the phase speed, modulations that may not be anticipated from measurements of the phase speeds of individual Fourier components travelling (to leading order) at the linear phase speed (Lake and Yuen 1978). (22 refs.)

71584 Waves due to a moving line impulse on the surface of a running stream of finite depth. B.Ghosh, K.S.Chaudhuri (Dept. of Math., Jadavpur Univ., Calcutta, India).
Meccanica (Italy), vol.18, no.1, p.16-20 (March 1983).
The two dimensional wave motion due to a line impulse moving on the surface of a running stream of finite depth is considered. The wave integral is evaluated for large times and distances with the help of generalized functions. Some particular cases are considered and some physical aspects of the wave motion are discussed. (4 refs.)

71585 Fluctuating hydrodynamics and capillary waves. M.Grant, R.C.Desai (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Phys. Rev. A (USA), vol.27, no.5, p.2577-84 (May 1983).
The authors derive an equation of motion for the instantaneous position of a planar liquid surface using fluctuating hydrodynamics. For the fluid constrained to be in a nonequilibrium steady state by a small temperature gradient, they then obtain the dynamic structure factor $S_{ss}(q, \omega)$, which represents the spectrum of thermal ripplons (capillary waves) on the liquid surface. The analysis is done for both classical and quantum fluids. The authors find that there is an asymmetry in the heights of the two ripplon peaks in $S_{ss}(q, \omega)$ due to broken time-reversal symmetry. The numerical estimates of the effect for liquid helium II, suggest that it could be measurable. They have undertaken a moment analysis of $S_{ss}(q, \omega)$; the first frequency moment is long ranged ($\sim 1/q^2$) in the steady state, though it vanishes in equilibrium. From the zeroth frequency moment they recover the familiar result for the infrared logarithmic divergence of the mean-square displacement of the interface; the analysis explicitly involves the coupling of the surface to the bulk fluid. They modify the so-called capillary-wave model by including the surface-bulk coupling, and thereby make it consistent with the capillary-wave dispersion. (25 refs.)

71586 Gravity waves in a channel with a rough bottom. R.Rosales, G.C.Papanicolaou (Courant Inst., MIT, New York, NY, USA).
Stud. Appl. Math. (USA), vol.68, no.2, p.89-102 (April 1983).
The effect of bottom irregularities on surface waves in a shallow channel can be analyzed rather well in the linear regime. This can be done by reducing the problem to the analysis of a one dimensional wave equation with random coefficients, which in turn can be studied in a number of different asymptotic limits. The authors study now nonlinearities due to finite amplitude surface disturbances interact with bottom irregularities to affect the evolution of the surface disturbances. They derive effective equations for the surface elevation of gravity waves in a shallow channel with a rough bottom. (4 refs.)

71587 Long eddies in sheared flows. E.Varley, P.A.Blythe (Lehigh Univ., Bethlehem, PA, USA).
Stud. Appl. Math. (USA), vol.68, no.2, p.103-87 (April 1983).
The characteristic feature of the wide variety of hydraulic shear flows analyzed is that they all contain a critical level where some of the fluid is turned relative to the ambient flow. One example is the flow produced in a thin layer of fluid, contained between lateral boundaries, during the passage of a long eddy. The boundaries of the layer may be rigid, or flexible, or free; the fluid may be either compressible or incompressible. A further example is the flow produced when a shear layer separates from a rigid boundary producing a region of recirculating flow. The equations used are those governing inviscid hydraulic shear flows. They are similar in form to the classical boundary layer equations with the viscous term omitted. The main result of the study is to show that when the hydraulic flow is steady and contained between lateral boundaries, the variation of vorticity $\omega(\psi)$ cannot be prescribed at any streamline which crosses the critical level. This variation is, in fact, determined by (1) the vorticity distribution at all streamlines which do not cross the critical level, by (2) the auxiliary conditions which must be satisfied at the boundaries of the fluid layer, and by (3) the dimensions of the region containing the turned flow. (10 refs.)

71588 Influence of the shape of a collapsing 'spot' and the fluid boundaries on internal wave formation in a stratified medium. V.I.Nikishov, A.G.Stetsenko (Inst. of Hydromech., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Appl. Mech. (USA), vol.18, no.7, p.652-6 (July 1982). Translation of: *Prikl. Mekh. (USSR)*, vol.18, no.7, p.93-7 (July 1982). [received: March 1983]
Examines internal wave formation by the collapse of a domain of homogeneous fluid ('spot') of different shape (circle, rectangle) in a stratified fluid of finite depth, and the influence of the shape of the domain and the closeness of the walls on the nature of this process is investigated. (12 refs.)

Flow near a vibrating cylinder .... See Entry 71564

The two-dimensional oscillating airfoil: a new implementation of the galerkin method .... See Entry 71591

Nonlinear stage of the shearing instability in a stratified liquid of finite depth .... See Entry 71626

The kinematics of stratified mixing through internal wavebreaking .... See Entry 71627

Secondary instability of wall-bounded shear flows .... See Entry 71652

The hydraulic resistance of a horizontal rectangular channel with stratified two-phase flow .... See Entry 71656

Surface-wave diffraction by a periodic row of submerged ducts .... See Entry 73830

47.40 COMPRESSIBLE FLOWS; SHOCK AND DETONATION PHENOMENA

(see also 28.70 Nuclear explosions, 52.35T Plasma shock waves)

71589 Asymptotic theory of flow separation from wings of low aspect ratio. S.B.Zakharov, G.G.Sudakov.
Fluid Dyn. (USA), vol.17, no.4, p.604-9 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.141-7 (July-Aug. 1982). [received: April 1983]
Numerous methods have been developed to calculate the aerodynamic characteristics of wings of low aspect ratio in the case when there is flow separation from the wing edges. Among the methods based on direct solution of the three-dimensional Euler equations there are the method of discrete vortices and the panel method. In addition, numerical and asymptotic methods based on the theory of slender bodies are used. One of the most important shortcomings of this theory is the dependence of the flow pattern at a given section of the wing on only the upstream flow. The authors construct an asymptotic theory of higher approximation and a corresponding numerical method for calculating flow separation from wings of low aspect ratio in which this shortcoming is absent. (14 refs.)

Viscous stability of compressible axisymmetric jets .... See Entry 71618

A composite model for the conserved scalar PDF [of turbulent reacting flows] .... See Entry 71664

The induction period of a thermal explosion in a gas between infinite parallel plates .... See Entry 73336

47.40D General subsonic flows

71590 Relation between fluid viscosity and compressibility. Yu.A.Atanov, A.I.Berdenikov.
J. Eng. Phys. (USA), vol.43, no.2, p.878-83 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.239-44 (Aug. 1982). [received: April 1983]
Values of the shear viscosity are computed with an error not exceeding the error of experiment by means of formulas deduced on the basis of the theory of a free volume. (15 refs.)

71591 The two-dimensional oscillating airfoil: a new implementation of the galerkin method. W.F.Moss (Dept. of Math. Sci., Old Dominion Univ., Norfolk, VA, USA).
SIAM J. Numer. Anal. (USA), vol.20, no.2, p.391-9 (April 1983).
A new implementation of the Galerkin method is applied to the integral equation of Possio (1938), which arises in the study of oscillating airfoils. The novel feature here is the use of a partial difference equation to compute the coefficient matrix of the Galerkin system. The chebyshev polynomials used in previous work are replaced by airfoil polynomials. The error analysis of earlier work is applied, and numerical solutions are compared with the exact solutions of Kussner and Schwarz (1940) in the Mach number zero case. (15 refs.)

An interaction algorithm for three-dimensional turbulent subsonic aerodynamic juncture region flow .... See Entry 71524

Freestream turbulence effects on attached subsonic turbulent boundary layers .... See Entry 71531

Normal oscillations of an ideal compressible liquid in rotating elastic vessels .... See Entry 71576

47.40H Transonic flows

71592 Numerical computation of transonic flows over airfoils and cascades. X.Zhou, F.Zhu (Northwestern Polytech. Univ., Xi'an, China).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.3, p.277-88 (May 1983).
The transonic flows over airfoils and cascades are computed by means of othe time-dependent finite-volume method. The computed results are in good agreement with experimental data. The effect of applying a variable time step as large as is locally allowed by stability as well as a refined-mesh approach on the convergence rate are investigated. The authors adopt the requirement of constant stagnation enthalpy along a streamline instead of the energy equation in the governing equations, derive the stability conditions for the difference equation and find that the stability is improved. (8 refs.)

47.40K Supersonic and hypersonic flows

71593 High resolution submillimeter-wave radiometry of supersonic flow. G.F.Dionne, J.A.Wiess, J.F.Fitzgerald, H.R.Fetterman (Lincoln Lab., MIT, Lexington, MA, USA), M.M.Litvak.
Appl. Phys. Lett. (USA), vol.42, no.10, p.862-4 (15 May 1983).
The recent development of a high-resolution submillimeter-wave heterodyne radiometer has made possible the first measurements of H_2O molecule rotational line excitation temperatures and detailed profiles in supersonic flow. Absorption signals were measured across the flow for the $2_{11} \leftarrow 2_{02}$ (752 GHz) para-H_2O rotational transition against a hot background. These signals decrease downstream owing to the volume expansion of the gas away from the sonic nozzle exit in the high-vacuum chamber. Radiative transfer calculations based on the large-velocity-gradient approximation and multilevel statistical equilibrium agree with these results and with the measured spectral line shapes. The data reveal nearly isentropic gas expansion and cooling. These studies have shown that submillimeter-wave heterodyne radiometry can be useful for remote sensing of supersonic flow with low mass flux, provided the signal transmission is through a dry or thin atmosphere. (8 refs.)

71594 Wall pressure fluctuations in attached boundary-layer flow. A.L.Laganelli, A.Martellucci (Sci. Applications Inc., Wayne, PA, USA), L.L.Shaw.
AIAA J. (USA), vol.21, no.4, p.495-502 (April 1983).
An examination has been made to derive a correlation for an aeroacoustic environment associated with attached compressible flow conditions. It was determined that fluctuating pressure characteristics described by incompressible theory as well as empirical correlations could be modified to a compressible state through a transformation function. Compressible data were transformed to the incompressible plane where direct use of more tractable prediction techniques are available for engineering design analyses. The investigation centered on algorithms associated with pressure magnitude and power spectral density. The method and subsequent prediction techniques are shown to be in excellent agreement with both incompressible and compressible flow data. (22 refs.)

71595 Similarity of the flow of strongly underexpanded gas jets exhausting into a hypersonic flow. G.A.Khramov, S.F.Chekmarev.
Fluid Dyn. (USA), vol.17, no.4, p.580-7 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.113-20 (July-Aug. 1982). [received: April 1983]
The authors consider an underexpanded jet exhausting into an ambient flow under the general conditions: $M_c^2 \gg 1$, $\theta_c^2 \ll 1$, $M_\infty^2 \gg 1$, $n \gg 1$. M_c and M_∞ are the Mach numbers at the nozzle exit and in the ambient flow, θ_c is the nozzle's half-angle and n the pressure ratios p_c/p_∞. They assume that the gas is an ideal fluid and that the shock waves and boundary of the jet are surfaces of discontinuity. (9 refs.)

71596 Computation of hypersonic viscous flow over a body with mass transfer and/or spin. M.D.Kim (Dept. Aerospace & Ocean Engng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA), C.H.Lewis.
J. Spacecr. & Rockets (USA), vol.20, no.2, p.101-7 (March-April 1983).
Computational results of hypersonic laminar viscous flow over blunt-nosed bodies with mass transfer and/or spin are presented. An implicit-iterative numerical scheme at each marching step is used to solve the parabolized Navier-Stokes equations. The code takes into account the mass-transfer and spin effects in the boundary conditions at the body surface and the periodic effect in the boundary condition around the body. To facilitate convergence, the v-momentum equation has been used rather than the continuity equation to provide the pressure at the body boundary. The coupled effects of mass transfer and spin on the Magnus force and surface measurable quantities were substantial. (12 refs.)

Influence of a counterpressure on the operation of a CO_2 gasdynamic laser emitting at 18.4 μ ....See Entry 71105

Influence of the angle of attack on the transition from a laminar to a turbulent boundary layer in the case of supersonic flow past sharp circular cones ....See Entry 71515

Compressible turbulent boundary layer in strong adverse pressure gradient ....See Entry 71533

Investigation of flow past blunt bodies with allowance for radiation by the large-particle method ....See Entry 71548

Couette flow in continuum to the free molecular regime ....See Entry 71574

Forces exerted by a weak shock wave on a wing of complicated shape in plan at supersonic velocities ....See Entry 71602

Non-intrusive measurement of aerodynamic flow ....See Entry 71673

47.40N Shock-wave interactions

71597 On regular reflection of a shock wave from a rigid wall. V.M.Teshukov.
Appl. Math. & Mech. (USA), vol.46, no.2, p.167-74 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.225-34 (1982).
The three-dimensional problem of reflection of a shock wave of arbitrary front shape from a fixed rigid wall is considered. Existence of a piecewise analytic solution of the problem defining the initial stage of regular reflection is proved. Expansion of solution behind the reflected wave front in converging power series in the neighborhood of the incident wave (of the moving along the wall intersection line of the incident wavefront and the rigid wall) is obtained for prolonged instants of time. It is shown that such expansions generally occur only then, when the length of the trace velocity vector relative to gas behind the reflected wave projected on the plane normal to the trace exceeds the speed of sound. (5 refs.)

71598 The inversion of a spherical compression wave in fluid. V.N.Likhachev.
Appl. Math. & Mech. (USA), vol.46, no.2, p.175-9 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.235-40 (1982).
The spherically symmetric motion of fluid under the action of a spherical piston is considered. The method of merging asymptotic expansions in a small parameter which defines the low compressibility of fluid is used. The inversion of a compression wave is investigated. The point of inversion is determined and the asymptotics of solution in its neighborhood, which replaces the initial condition for shock wave construction, is obtained. (3 refs.)

71599 Spherically-symmetric shock wave in a dilatant medium. S.G.Artyshev, E.K.Bokovaia, V.A.Bokovoi.
Appl. Math. & Mech. (USA), vol.46, no.2, p.271-4 (1982). Translation of: *Prikl. Mat. & Mekh. (USSR)*, vol.46, no.2, p.349-52 (1982).
The problem is examined of the expansion of a spherical region filled with a gas with high initial pressure, in a continuous medium with dilatancy, by which is meant the kinematic connection between the velocities of the dilatational and the maximal tangential deformations. The change in the medium's density behind the shock wave's front takes place only due to this kinematic connection. The model given was previously used mainly for describing the behavior of certain soils in an underground explosion. The soil density behind the shock wave's front had been reckoned to be constant. An analogous problem is examined in the case when the dilatancy velocity coefficient is a piecewise-constant function of the medium's density. (6 refs.)

71600 Shocks in gas pipelines. D.Marchesin (Dept. de Matematica, Pontifica Univ. Catolica do RJ, Rio de Janeiro, Brazil), P.J.Paes-Leme.
SIAM J. Sci. & Stat. Comput. (USA), vol.4, no.1, p.105-16 (March 1983).
The uniform sampling method to study shocks and spikes in transient flow in gas pipelines. The method is well suited for this purpose. Both shocks and spikes tend to be masked by the use of a conventional damping term known as Moody friction. They are also masked by standard numerical schemes. (18 refs.)

71601 Absorption waves in gases. I.V.Nemchinov (Inst. of Earth Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1026-36 15-24 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
The propagation of absorption waves in the opposite direction to the laser beam is considered (subsonic and supersonic radiation waves and also light-detonation ones). Simple models are presented that describe the basic parameters of these waves, along with results from detailed numerical calculations. A comparison is made with experiment. (46 refs.)

71602 Forces exerted by a weak shock wave on a wing of complicated shape in plan at supersonic velocities. M.I.Nisht, A.F.Polovkov, S.A.Popytalov.
Fluid Dyn. (USA), vol.17, no.4, p.587-92 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.121-7 (July-Aug. 1982). [received: April 1983]
A method is presented for calculating the supersonic distributed and total aerodynamic characteristics of a wing of complicated shape in plan, including a wing having the shape of an aircraft in plan which encounters a weak shock wave of arbitrary orientation: The problem is solved in the linear formulation. (6 refs.)

71603 Invariant solutions of the equations of motion of ionized gas. N.S.Zakharov, V.P.Korobeinikov (V.A. Stekiov Math. Inst., Acad. of Sci., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.929-32 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.299-303 (Aug. 1982). [received: April 1983]
Group analysis of the equations of motion of ionized gas heated by external radiation is performed. The problem of self-similar flow of completely ionized gas is solved numerically. (5 refs.)

71604 Effects of radius of curvature and initial angle on the shock transition over concave or convex walls. K.Takayama (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan), M.Sasaki.
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.1-30 (1983).
The effects of radii of curvature and initial angles of concave or convex walls on the shock transition in truly non-stationary flows are investigated experimentally. Experiments were conducted on concave or convex walls with radii of curvature 20 mm to 300 mm for nitrogen at 1.0-100 KPa and shock Mach number 1.05-4.0 by using a 40 mm×80 mm shock tube equipped with a double exposure holographic interferometer and a streak camera with curves slits. It is revealed that in concave walls with larger radii of curvature the shock transition angle from Mach reflection to regular reflection (MR→RR) approaches the von Neumann criterion, whereas in convex walls with larger radii of curvature the shock transition angle from regular to Mach reflection (RR→MR) approaches to the detachment criterion. The effect of the initial angles becomes prominent in the convex wall but less sensitive in the convex wall. Isopycnic curves evaluated from the holographic interferograms are presented showing the hysteresis between the transition over concave and convex walls. The hysteresis in the MR⇄RR transition was very well interpreted by a multiple shock polar diagram. (16 refs.)

Investigation of numerical methods for solving the N-S equations ....See Entry 69889

The response of ring-stiffened elastic cylindrical shell of infinite length to a transverse shock wave ....See Entry 71425

Similarity of the flow of strongly underexpanded gas jets exhausting into a hypersonic flow ....See Entry 71595

Cavitation aspects in a Venturi ('Johnsson effects' in a low turbulence flow) ....See Entry 71617

47.45 RAREFIED GAS DYNAMICS

(see also 07.30 Vacuum production and techniques)

71605 Calculation of gas-dynamic parameters in the neighborhood of bodies in free-molecule streams. V.P.Bass, V.I.Brazinskii.
Fluid Dyn. (USA), vol.17, no.4, p.641-3 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.177-80 (July-Aug. 1982). [received: April 1983]
Considers the free-molecule flow of a rarefied gas past an arbitrary convex fixed body in the absence of external forces. The undisturbed flow is assumed to be an equilibrium flow with Maxwellian velocity distribution function of the molecules. (5 refs.)

71606 Dependence of tagged-particle motion on size and mass. A.J.Masters, T.Keyes (Sterling Chem. Lab., Yale Univ., New Haven, CT, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2603-15 (May 1983).
Tagged-particle motion in fluids is studied as a function of size and mass via variational solutions of the repeated-ring and self-consistent repeated-ring equations. For a massive particle, the transition from Boltzmann to Stokes-Einstein behavior is found as the particle radius varies from small to large with respect to the mean free path. New and more complicated effects are found for light particles. The theory appears to provide an explanation of the results of the computer simulation of Alder and Alley (1978) on size and mass dependence. (18 refs.)

Couette flow in continuum to the free molecular regime ....See Entry 71574

Density distribution of a molecular stream over surfaces of a vacuum channel ....See Entry 71650

Evaluation and calculation of gas flow through axially symmetric tubes ....See Entry 71657

47.50 NON-NEWTONIAN DYNAMICS

71607 Internal variables and the thermodynamics of macromolecule solutions. G.A.Maugin, R.Drouot (Lab. de Mecanique Theorique, Univ. Pierre et Marie Curie, Paris, France).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.705-24 (1983).
In the modelling of the anomalous behavior of the flow of deformable macromolecules one recognizes the fact that the peculiarities of this flow are typically due to the deformability of the said molecules. In a continuum thermodynamical description this structural deformation can be conveniently characterized by means of a quantity which may be a scalar, a vector or a tensor, and is considered as a so-called internal variable in the sense that it satisfies a time-evolution equation while the global thermodynamical behavior of the solution is still governed by the usual balance laws of continuum thermomechanics. Two cases are presented: (i) one for dilute polymer solutions where the internal variable is a symmetric second-order tensor (practically, the mean inertia of entangled molecules); (ii) another one in which the internal variable is a vector (which represents the mean extensional molecular deformation) and which aims at reproducing the behavior of rodlike macromolecules (as in charged polyelectrolytes) and which, combined with a finer kinematical description in the fluid flow, allows for the existence of remarkable migration phenomena. (62 refs.)

71608 Drag reduction and mechanical degradation in polymer solutions in flow. W.Brostow (Dept. of Materials Engng., Drexel Univ., Philadelphia, PA, USA).
Polymer (GB), vol.24, no.5, p.631-8 (May 1983).
A list of conclusions from experimental studies of drag reduction (*DR*) and mechanical degradation in flow (*MDF*) is made. A statistical-mechanical model of chain conformations developed by the author (1982) is used and its consequences for *DR* and *MDF* established. Experimental findings are explained in terms of the model, including those considered to be puzzling and contrary to expectations. A relation between the extent of mechanical degradation and flow time is derived. The equation obtained for relative drag reduction in function of time reproduces perfectly the experimental data for polystyrene+toluene solutions reported by Hunston and Zakin (1980). Some predictions from the present model have yet to be tested experimentally. (57 refs.)

71609 Studies of bubble behavior and non-Newtonian viscosity of polymer solutions. I.. A.Shima (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan), T.Tsujino, J.Tanaka.
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.103-29 (1983).
In order to make clear the bubble behavior of polymer solutions, rheological properties of PEO (polyethylene oxide) solutions and PAM (*N*-110) (polyacrylamide) solutions are experimentally analysed by using a rheometer of cone and plate type, and then a rheological equation is proposed. By utilizing the result, the equation of motion for a bubble and the pressure equation are theoretically obtained. According to numerical calculations of the derived equations, the effects of a polymer concentration and a size of initial bubble radius on the relation of bubble radius-time and the maximum impulse pressures occurring from the bubble are clarified. (24 refs.)

71610 Studies of bubble behavior and non-Newtonian viscosity of polymer solutions. II.. T.Tsujino (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan), A.Shima.
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.131-51 (1983).
For pt.I see ibid., vol.46, p.103 (1983). Taking up Polyox and PAM (*A*-20*P*) as polymer additives, rheological characteristics for these polymer solutions are experimentally analysed as a continuation of a previous report of the same title. As a result, it is found that the rheological behavior of these polymer solutions are well represented by the rheological model proposed in the previous paper. Then numerical calculations are conducted for the bubble behavior and the impulse pressure in Polyox solutions and PAM (*A*-20*P*) solutions. An experimental equation which represents the relation of surface tension of polymer solutions with polymer concentration is made. (3 refs.)

71611 Studies of bubble behavior and non-Newtonian viscosity of polymer solutions. III.. T.Tsujino (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan), A.Shima.
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.153-80 (1983).
For pt.II see ibid. vol.46, p.131 (1983). By analysing experimentally rheological characteristics of carboxymethylcellulose solutions and hydroxyethylcellulose solutions it is found that the rheology of these polymer solutions are well represented by a rheological model proposed in a previous paper. The motion of a bubble and impulse pressures in these polymer solutions are numerically made clear, which are compared with the cases of polyethylene oxide solutions and polyacrylamide solutions considered in the previous reports. As a result, it is clarified that PAM (*N*-110) is the most effective polymer on a decrease of impulse pressure, that the polymer effects in PEO solutions and CMC-4H solutions are comparatively large, and that the decreasing rates of impulse pressure in Polyox solutions, CMC-BS solutions, and HEC solutions are less than the other polymer solutions. Measurement for the surface tensions of CMC solutions and HEC solutions is also made. (15 refs.)

71612 On the behavior of bubbles in viscoelastic fluids. I. A.Shima (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan), T.Tsujino, J.Tanaka.
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.181-98 (1983).
By using the Oldroyd model proposed by Williams and Bird (1962), the equation of motion for a bubble and the pressure equation were obtained, and then examples of numerical calculations were shown for the bubbles in a 4.0% CMC solution and a 0.025% SPM solution. Consequently, viscoelastic polymer effects on the variation with time of the bubble radius and the impulsive pressure occurring from the bubble were made clear. (15 refs.)

Slow motion of a sphere through an anisotropic, viscoelastic fluid ....See Entry 71507

Riblets as a visuous drag reduction technique ....See Entry 71530

Slow flow of gas past a strongly heated sphere in the presence of blowing and evaporation from its surface ....See Entry 71536

Natural convection produced by unsteady heating of a viscoplastic liquid in a plane vertical layer ....See Entry 71549

Examination of the formation of finite disturbances in the course of the convection of a viscoelastic liquid within a horizontal layer ....See Entry 71556

Coaxial-disk flow and flow about a rotating disk of a Maxwellian fluid ....See Entry 71568

Jets into liquid under gravity ....See Entry 71620

Peristaltic flow of viscoelastic liquids ....See Entry 71651

Complementary variational principles for Poiseuille flow of an Oldroyd fluid ....See Entry 71655

47.55 NONHOMOGENEOUS FLOWS

71613 Experimental measurements of the effect of viscosity on drag for liquid drops. P.H.Gillaspy, T.E.Hoffer (Desert Res. Inst., Univ. of Nevada System, Reno, NV, USA).
AIChE J. (USA), vol.29, no.2, p.229-36 (March 1983).
The drag coefficients of drops of various liquids falling in air were measured experimentally. The drag coefficient was linearly related to the viscosity in the Reynolds number and viscosity range measured. Measurements also suggested there is no difference between Newtonian and nonNewtonian liquids. (23 refs.)

71614 Equilibrium shapes and stability of rotating drops. V.A.Arkhipov, V.P.Bushlanov, I.M.Vasenin, V.V.Rusakov, V.F.Trofimov.
Fluid Dyn. (USA), vol.17, no.4, p.498-504 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.13-20 (July-Aug. 1982). [received: April 1983]
Direct variational methods are used to obtain nonaxisymmetric equilibrium shapes of a rotating drop. The results are given of experiments on the interaction of freely floating drops of viscous fluid. It is shown that if the dimensionless angular momentum of the system is $\Omega > 3.4$, then a sequence of three-dimensional shapes similar to ellipsoids bifurcates from the sequence of axisymmetric shapes. The stability of these shapes is studied in Poincare's scheme. (8 refs.)

71615 Motion of a drop with allowance for thermocapillary forces. V.Ya.Rivkind, G.S.Sigovtsev.
Fluid Dyn. (USA), vol.17, no.4, p.554-9 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.80-6 (July-Aug. 1982). [received: April 1983]
A study is made of the motion of a drop in a viscous medium of nonuniform temperature when the dependence of the surface tension on the temperature at the interface of the two media gives rise to additional tangential stresses leading to thermocapillary convection in fluids. The motions of a spherical drop and a deformed drop (when the surface of the drop is determined in the process of finding the solution) are considered. The shape of the drop surface is calculated for different values of the parameters of the problem. Dependences are obtained for the Reynolds number of the thermocapillary drift of drops in the absence of body forces. (13 refs.)

47.55B Cavitation

71616 Singular behavior of cavitation in undersaturated water. R.Oba (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan), K.T.Kim, K.Uranishi.
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.75-88 (1983).
In order to clarify the effects of contained air in water upon cavitation, especially in the range from the inception to the desinence, the cavitation-aspects, the associated sound-pressures as well as wall-pressure-fluctuations, and the nuclei size-distribution of test-water are simultaneously observed in the water-flow through an orifice, for various state of water, in which the degree of air-saturation covers from undersaturation to oversaturation. A drastic change in the aspects is clearly observed, with respect to the degree of saturation, i.e. either at undersaturation or at oversaturation, even when the cavitation-nuclei are almost equivalent to each other. (14 refs.)

71617 Cavitation aspects in a Venturi ('Johnsson effects' in a low turbulence flow). R.Oba, Y.Ito (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan).
Rep. Inst. High Speed Mech. Tohoku Univ. Ser. B (Japan), vol.46, p.89-102 (1983).
Recently, the appearance of incipient cavitation was quite differently observed on the ITTC standard body, a kind of axisymmetric body, in different cavitation tunnels widely distributed in the world, even when the cavitation number as well as the Reynolds number was fixed. It is, therefore, recognized by the authors as if the so-called Johnsson effects required the reexamination of the several existing results on cavitation. The cavitation aspects and the shock sound pressures were carefully investigated in a typical internal flow through a Venturi, in which the turbulence intensity was expectedly low and the flow was principally characterized by the shear as well as the vortices. Several results show that the controlling factors of the Johnsson effects were obtained not only in desinent cavitation but also in well-developed cavitation. (12 refs.)

Theoretical investigation of the response of gas-filled micropores and cavitation nuclei to ultrasound ....See Entry 71283

Regulating valves: the noise problem. I ....See Entry 71646

47.55C Jets

71618 Viscous stability of compressible axisymmetric jets. P.J.Morris (Pennsylvania State Univ., University Park, PA, USA).
AIAA J. (USA), vol.21, no.4, p.481-2 (April 1983).
Calculations of the viscous, spatial stability characteristics of a compressible axisymmetric jet are presented. The asymptotic solutions to the stability equations in regions of constant mean flow properties are developed and used as the boundary conditions for a numerical integration of the compressible stability equations in cylindrical coordinates. Increasing the Mach number is found to stabilize the flow, as is decreasing the Reynolds number. The helical mode is found to be more unstable than the axisymmetric mode for higher Mach numbers. (8 refs.)

71619 Numerical calculations of steady three-dimensional turbulent jets in cross flow. A.O.Demuren (Sonderforschungsbereich, Univ. Karlsruhe, Karlsruhe, Germany).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.3, p.309-28 (May 1983).
Presents calculations of the steady flow of a row of turbulent jets issuing normally into a nearly uniform cross flow, using three-dimensional finite-difference numerical procedures. One procedure uses a quadratic upstream weighted (QUICK) difference scheme in representing the convection terms, while the other uses a hybrid central/upwind difference scheme. The calculations with the former are shown to be superior to those with the latter for all grid distributions. Fine grid calculations with the QUICK scheme are shown to agree fairly well with experimental measurements of total pressure distributions immediately downstream of the jet discharge. The agreement becomes worse further downstream, and it is shown that this may be due to the inability of the k-ϵ turbulence model to correctly reflect the complex turbulent structure in the wake region. Estimates are provided to the relative magnitudes of the three-dimensional false or numerical diffusivities, resulting from the use of upwind differencing. The QUICK and hybrid schemes are shown to produce closer results when these false diffusivities are not much higher than the physical diffusivity. (23 refs.)

71620 Jets into liquid under gravity. D.D.Joseph, K.Nguyen (Dept. of Aerospace Engng. & Mech., Univ. of Minnesota, Minneapolis, MN, USA), J.E.Matta.
J. Fluid Mech. (GB), vol.128, p.443-68 (March 1983).
The authors study the flow of a heavy, viscous, possibly non-Newtonian axisymmetric jet of liquid of density ρ falling under gravity g into a lighter liquid of density $\tilde{\rho}$. If the change in the momentum of the entrained lighter liquid is neglected the jet will ultimately reach a modified Torricelli limit with a speed given by $U(x)=[2(\delta\rho/\rho)gx]^{1/2}$ and an asymptotic radius $a(x)=[2Q^2/(\delta\rho/\rho)gx]^{1/4}$, where x is the downstream distance, $\delta\rho=\rho-\tilde{\rho}>0$ and $2Q$ is the volume flow. An exact asymptotic solution perturbing the Torricelli limit with effects of surface tension, viscosity and elasticity is given in powers of $x^{-1/4}$. An extended unsteady problem including effects of entrainment is formulated in terms of nonlinear ordinary differential equations which also account for weak radial variations of the velocity across the cross-section of the jet. (10 refs.)

71621 Experimental investigation of a turbulent jet in turbulent cross flow. L.N.Voitovich.
J. Eng. Phys. (USA), vol.43, no.2, p.866-8 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.225-8 (Aug. 1982). [received: April 1983]
The characteristics of an axisymmetric turbulent jet propagating in a cross flow with a high degree of turbulence are investigated experimentally. (7 refs.)

Similarity of the flow of strongly underexpanded gas jets exhausting into a hypersonic flow .... See Entry 71595

Visualization of multijet impingement flow .... See Entry 71667

Calibration of a jet flowmeter on a substitute liquid .... See Entry 71671

Supersonic jets, rotational cooling, and analytical chemistry ... See Entry 73380

47.55E Nozzles

71622 Results of the investigation of the motion of particles in a Laval nozzle. S.F.Ignatov, D.S.Mikhatulin, I.V.Chirkov.
Fluid Dyn. (USA), vol.17, no.4, p.626-31 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.163-8 (July-Aug. 1982). [received: April 1983]
The calculation of the two-phase flow in a nozzle was made using the model of two interpenetrating media (a gas and particles). The main assumptions are that the gas is perfect, inviscid, and does not conduct heat; the viscosity and heat transfer can be taken into account only in the interaction between the gas and the particles; and the particles do not interact with one another. (11 refs.)

71623 Calculation of gas flow in a Laval nozzle in the presence of nonequilibrium physiocochemical processes. M.Ya.Ivanov, V.A.Sal'nikov.
Fluid Dyn. (USA), vol.17, no.4, p.637-40 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.173-7 (July-Aug. 1982). [received: April 1983]
An explicit divergence difference scheme of third order of approximation with respect to the spatial variables is used to calculate two-dimensional steady flows of an inviscid gas that does not conduct heat in contracting-expanding nozzles in the presence of nonequilibrium physicochemical processes. The flow structure is demonstrated for a three-component vibrationally nonequilibrium gas mixture in planar Laval nozzles with different radii of curvature of the nozzle profile in the neighborhood of the critical section. (15 refs.)

71624 Experimental investigation of flow rate and thrust characteristics of a four-nozzle ejector with swirling flow. Yu.A.Lashkov, E.A.Shumilkina.
Fluid Dyn. (USA), vol.17, no.4, p.649-53 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.185-9 (July-Aug. 1982). [received: April 1983]
The authors have made an experimental investigation of the thrust and the flow rate characteristics of a low-pressure ejector with swirling flow in a wider range of variation of the relative pressure difference at the active nozzles ($\sigma_{max} \approx 7$). They investigated an axisymmetric ejector with four active nozzles distributed uniformly around a circle. (4 refs.)

71625 A finite element approach for predicting nozzle admittances. R.K.Sigman, B.T.Zinn (School of Aerospace Engng., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Sound & Vib. (GB), vol.88, no.1, p.117-31 (8 May 1983).
A finite element method is used to predict the admittances of axisymmetric nozzles. It is assumed that the flow in the nozzle is isentropic and irrotational, and the disturbances are small so that linear analyses apply. An approximate, two dimensional compressible model is used to describe the steady flow in the nozzle. The propagation of acoustic disturbances is governed by the complete linear wave equation. The differential form of the acoustic equation is transformed to an integral equation by using Galerkin's method and Green's theorem is applied so that the acoustic boundary conditions can be introduced through the boundary residuals. The boundary conditions are described for both straight and curved sonic lines. A two dimensional FEM with linear elements is used to solve the acoustic equation. A one dimensional FEM is also used to solve the reduced equation of Crocco (1967), and the solution verifies the sufficiency of the boundary residual formulation. Comparison between computed admittances and experimental data is shown to be quite good. (23 refs.)

PWR nozzle 'crotch corner' inspection: an effective additional ultrasonic technique for radial cracks .... See Entry 70716

47.55H Stratified flows

71626 Nonlinear stage of the shearing instability in a stratified liquid of finite depth. L.A.Ostrovskii, Yu.A.Stepanyants.
Fluid Dyn. (USA), vol.17, no.4, p.540-6 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.63-70 (July-Aug. 1982). [received: April 1983]
Considers the nonlinear problem of the generation of internal waves in a two-layer incompressible liquid of finite depth with a tangential discontinuity of the velocity. It is well known that in such a flow model (without allowance for the surface tension between the layers) the Kelvin-Helmholtz instability occurs in the region of sufficiently large wave numbers, and this usually leads to rapid development of turbulence at the interface. At smaller wave numbers there is no instability because of the stabilizing effect of the stratification. In this region there are waves with negative energy, which are unstable if allowance is made for the factors that can take energy from them. Despite their relatively small (compared with the Kelvin-Helmholtz case) growth rate, such waves are of interest for describing real oceanic processes, since they are associated with a long-wavelength instability of flows that is not restricted by the finite thickness of the transition region between the layers. (15 refs.)

71627 The kinematics of stratified mixing through internal wavebreaking. A.D.McEwan (CSIRO Div. of Atmospheric Phys., Mordialloc, Victoria, Australia).
J. Fluid Mech. (GB), vol.128, p.47-57 (March 1983).
The evolution of an internal wavebreaking event in a continuous stable stratification is examined using schlieren colour imagery combined with streak photography. For standing but strongly interacting wavemodes forced to breaking, the Richardson number defined by local gradients of density and velocity is critically low only in the immediate vicinity of the breaking region where convective overturning also occurs. Breaking and vertical mixing results from the rapid development of three-dimensional interleaving density microstructure within a confined volume which persists and gravitates to modify weakly the surrounding density distribution. Continual mixing through internal motion is seen as a widespread repetition of such events. A general description of the process is proposed and applied in two types of simple kinematical model to provide an estimate of 'mixing efficiency', the ratio of potential energy gained through stratification weakening to kinetic energy expended in motions on the scales of the mixing event. These models do not rely on an assumed similarity between momentum and buoyancy transfer. (10 refs.)

71628 Internal mixing in stratified fluids. A.D.McEwan (CSIRO Div. of Atmospheric Phys., Aspendale, Victoria, Australia).
J. Fluid Mech. (GB), vol.128, p.59-80 (March 1983).
Using experimental measurements, estimates are made of the efficiency of conversion of kinetic energy into potential energy through vertical mixing in a continuously stratified fluid. In the experiments kinetic energy was supplied continuously at a rate of ϵ to a fundamental internal wave mode in a rectangularly bounded and initially linear stable stratification. Mixing resulted from the instability of this wave and its consequent 'breaking'. Potential energy was gained by the system at rate p through the gradual weakening of the stratification. The instability is predictable using wave-interaction theory, affording a means of estimating the amount of kinetic energy lost (at rate ϵ_V) to laminar viscosity without first cascading to the fine scales characteristic of turbulent mixing. (17 refs.)

Potential function and problems of oscillations of an exponentially stratified liquid .... See Entry 71575

Influence of liquid viscosity and Coriolis force on the stability of internal waves .... See Entry 71577

Influence of the shape of a collapsing 'spot' and the fluid boundaries on internal wave formation in a stratified medium .... See Entry 71588

The hydraulic resistance of a horizontal rectangular channel with stratified two-phase flow .... See Entry 71656

Instability of horizontal fluid interface in a perpendicular electric field: observational study .... See Entry 71658

47.55K Multiphase flows

71629 Statistical study of the grid zone behavior in a shallow gas-solid fluidized bed using a mini-capacitance probe. N.Yutani, T.C.Ho, L.T.Fan, W.P.Walawender, J.C.Song (Dept. of Chem. Engng., Kansas State Univ., Manhattan, KS, USA).
Chem. Eng. Sci. (GB), vol.38, no.4, p.575-82 (1983).
The behavior of the grid zone in a shallow-air-sand fluidized bed was studied by means of a mini-capacitance probe coupled with the on-line correlation technique. Experiments were carried out in a bed with a diameter of 203 mm. The bed had a height of 50 mm and was operated at different air flow rates. A perforated 'plexiglas' plate with a hole diameter of 1.59 mm and a thickness of 9.53 mm was used as the distributor. The technique has been found to be effective in determining locally or microscopically the jet penetration depth and the dead zone height. The phenomenon of jetting in a shallow gas-solid fluidized bed is described semi-quantitatively. (19 refs.)

71630 Nonstationary movement of solids in a compressible viscous liquid. O.S.Basmat.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.4, p.36-40 (1983). In Ukrainian.
The problem of nonstationary movement is stated on the basis of general solutions of the Navier-Stokes linearized equations. The movement of a cylinder at initial time moments is studied. (8 refs.)

71631 Flow of electrically charged aerosols past bodies. A.B.Vatazhin, V.A.Likhter, V.I.Shul'gin.
Fluid Dyn. (USA), vol.17, no.4, p.547-54 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.71-9 (July-Aug. 1982). [received: April 1983]
An experimental investigation was made of the flow of electrically charged aerosols with solid or liquid disperse phase past bodies. Air flows with solid particles (sand, iron) and water drops were produced by special apparatus. The regimes in which the disperse particles and the bodies were charged or neutral were studied. A system of dimensionless numbers and their values are indicated for the different gas-dynamic and electric flow regimes. The main features of the flows are explained and the integrated electric characteristics of the bodies determined. The possibility of controlling the flow of a dispersion medium by means of electric fields is demonstrated. It is shown that the inductive charging of liquid films near sharp edges of a body has a strong influence on the electric characteristics of the body (when air with water drops flows past it). (15 refs.)

71632 Study of the drag of a throttle in the film boiling of a cryogenic liquid flowing in a horizontal pipe. S.K.Dymenko, A.A.Kurilenko, S.S.Kolesnikov.
J. Eng. Phys. (USA), vol.43, no.2, p.833-6 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.186-90 (Aug. 1982). [received: April 1983]
A one-dimensional model is used to calculate the parameters of a two-phase flow and generalize test data on discharge coefficients. (4 refs.)

71633 Ambiguity of the hydrodynamic characteristics (HDC) of boiling channels in cryogenic units. A.I.Ageev, V.F.Burinov, S.I.Zinchenko, Yu.P.Filippov (Joint Inst. of Nuclear Res., Dubna, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.837-40 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.190-5 (Aug. 1982). [received: April 1983]
Criteria are obtained for the ambiguity of HDC of boiling channels which allow for local inlet and outlet drag. Results of calculations presented for the most commonly used cryogens indicate the possible ambiguity of the HDC. (6 refs.)

71634 Experimental study of the drag of a two-phase helium flow in channels. I.P.Vishnev, L.N.Migalinskaya, I.B.Lebedeva (All-Union Sci.-Res. Inst. of Helium Engng., Moscow).
J. Eng. Phys. (USA), vol.43, no.2, p.841-6 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.195-201 (Aug. 1982). [received: April 1983]
Results are presented from an experimental study of the drag of a turbulent two-phase helium flow in a horizontal channel under adiabatic conditions. (9 refs.)

71635 Modeling of mass-exchange processes taking into account fluctuations of the physicochemical parameters. F.G.Akhmadiev, A.A.Aleksandrovskii, I.N.Dorokhov (S.M. Kirov Kazansk Inst. of Chem. Technol., D.I. Mendeleev Inst., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.908-13 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.274-80 (Aug. 1982). [received: April 1983]
The Kolomogorov-Fokker-Planck equation is used to describe the kinetics of mass exchange, taking into account fluctuations of the main physical and the chemical parameters. The solution of the problem by classical methods, using averaging of the turbulent motion and averaging in the mechanics of dis-

persed media, is difficult. The authors present a simplified method which uses the theory of Markov diffusion processes. (11 refs.)

71636 Slow motion of a micropolar fluid through a porous sphere bounded by a solid sphere. B.S.Bhatt (Dept. of Maths., Univ. of the West Indies, St. Augustine, Trinidad).
Proc. Indian Acad. Sci. Math. Sci., vol.91, no.3, p.211-16 (Nov. 1982). [received: May 1983]
Examines the slow motion of a micropolar fluid produced by the relative motion of a solid sphere to an inside porous sphere. The result extends the Cunningham's problem to micropolar fluid when the inner sphere is porous with prescribed radial suction/injection velocity at the surface of the sphere. The result can also be taken as an extension of the work of Ramkissoon and Majumdar (1975) when the fluid is bounded at a radius $r=b$ $(b>a)$ but the solid sphere is replaced by a porous sphere. The force experienced by the inner sphere has been calculated and particular cases of interest have been deduced. (9 refs.)

Slow motion of a sphere through an anisotropic, viscoelastic fluid .... See Entry 71507

Unsteady Couette flow and heat transfer in a dusty gas .... See Entry 71545

The entry of a falling film into a pool and the air-entrainment problem .... See Entry 71580

Studies of bubble behavior and non-Newtonian viscosity of polymer solutions. I. .... See Entry 71609

Studies of bubble behavior and non-Newtonian viscosity of polymer solutions. II. .... See Entry 71610

Studies of bubble behavior and non-Newtonian viscosity of polymer solutions. III. .... See Entry 71611

On the behavior of bubbles in viscoelastic fluids. I .... See Entry 71612

Results of the investigation of the motion of particles in a Laval nozzle .... See Entry 71622

Convective instability of a homogeneous fluidized bed .... See Entry 71638

Kinetics of isothermal evaporation of a porous or dispersed body .... See Entry 71644

The hydraulic resistance of a horizontal rectangular channel with stratified two-phase flow .... See Entry 71656

Stabilization of bubble-liquid processes by an electric field ..... See Entry 71659

Flow of a stream containing charged inertial particles past a conducting sphere .... See Entry 71660

Dispersed powder flow through vertical pipes .... See Entry 71672

Ionic space charges generated by evaporating charged liquid sprays .... See Entry 71832

47.55M Flow through porous media

71637 Theory and experiment on the three-dimensional motion of a freely suspended spherical particle at the entrance to a pore at low Reynolds number. Z.Dagan, S.Weinbaum, R.Pfeffer (City Coll., City Univ. of New York, New York, NY, USA).
Chem. Eng. Sci. (GB), vol.38, no.4, p.583-96 (1983).
Examines the three dimensional approach of a neutrally buoyant sphere of any size to a circular hole in a plane wall at very low Reynolds number. The analysis differs from previous studies, largely applied to the multipore filter, in that the authors investigate the three dimensional hydrodynamic interaction of the sphere with the entrance geometry of the pore in the limit of zero inertia. The problem is first exactly formulated as the linear superposition of fundamental Stokes flows for rotation and translation of the sphere and flow past a stationary sphere. Approximate solutions are then obtained for the deviation of sphere trajectories from fluid stream lines and the results compared with laboratory model experiments in a low Reynolds number settling tank. The theory and experiment show that because of the hydrodynamic interaction sphere trajectories and fluid streamlines deviate significantly as the opening is approached, that all spheres eventually enter the pore regardless of their initial position, but that a non-uniform concentration profile develops with large increases in concentration near the walls of the orifice in the vicinity of the opening. The results provide a basic mechanism to explain the onset of Fahraeus phenomenon for red cells entering small blood vessels and glass tubes. (22 refs.)

71638 Convective instability of a homogeneous fluidized bed. Yu.P.Gupalo, Yu.S.Ryazantsev, Yu.A.Sergeev.
Fluid Dyn. (USA), vol.17, no.4, p.519-25 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.39-46 (July-Aug. 1982). [received: April 1983]
Convective motions of the phases in a homogeneous fluidized bed are considered. The motions of the phases are described by a simple model of two ideal interpenetrating interacting fluids. The model admits an increasing concentration of the solid particles with the height, which leads to circulatory flows. Approximate equations of motion of the liquid and the solid particles are obtained, and these are analogous to the Boussinesq approximation in the case of natural convection in a pure liquid. The equations contain a parameter which is analogous to the Rayleigh number and characterizes the stability of the layer. An approximate analytic solution to the corresponding eigenvalue problem is found. The spectrum of Rayleigh numbers and the sizes of the convective cells are determined. (16 refs.)

71639 Fluidization of an inhomogeneous granular layer in a field of centrifugal forces. N.N.Bobkov.
Fluid Dyn. (USA), vol.17, no.4, p.534-9 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.56-62 (July-Aug. 1982). [received: April 1983]
Considers a general theory of fluidization based on a continuum model of a rigid-plastic body and the condition of limiting equilibrium can be used to solve the problem of the transition to a suspended state of an inhomogeneous granular layer through which a liquid or gas flows in a field of centrifugal forces. The author shows that depending on the nature of the inhomogeneities and their position, there can either be uniform fluidization or else the formation of a discontinuity in the bed. The centrifugal acceleration is created by the rotation about its symmetry axis of a hollow circular cylinder on whose inner surface there is an annular layer of a free-flowing medium. The fluidizing agent is supplied uniformly through the porous cylindrical surface, which is impermeable for particles of the solid phase. The fluid moves radially in the direction of the cylinder axis. (5 refs.)

71640 Vorticity of the velocity field for flow in a porous medium with random inhomogeneities. M.I.Shvidler.
Fluid Dyn. (USA), vol.17, no.4, p.619-21 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.157-60 (July-Aug. 1982). [received: April 1983]
The vorticity field of the flow velocity in a porous medium with random inhomogeneities is considered in the correlation approximation of perturbation theory. The correlation tensor of the vorticity, the correlation between the vorticity and the permeability field, and the circulation of the velocity are calculated for three-and two-dimensional flows. (1 ref.)

71641 Self-similar solution to a problem of axisymmetric motion of gas through a porous medium in the case of a quadratic law of resistance. N.A.Kudryashov, V.V.Murzenko.
Fluid Dyn. (USA), vol.17, no.4, p.631-4 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.168-71 (July-Aug. 1982). [received: April 1983]
The results of solution of the self-similar problem of planar flow of gas through a porous medium in the case of a quadratic law of resistance are generalized to the case of axisymmetric motion. The equation in similarity variables for the velocity of isothermal gas flow is reduced to an equation having cylindrical functions as solution. Analytic dependences of the pressure and the gas velocity on the coordinate and time are obtained for a given flow rate of the gas at the coordinate origin and for zero initial gas pressure in the porous medium. (9 refs.)

71642 The boundary correction for the Rayleigh-Darcy problem: limitations of the Brinkman equation. D.A.Nield (Dept. of Math., Univ. of Auckland, Auckland, New Zealand).
J. Fluid Mech. (GB), vol.128, p.37-46 (March 1983).
The no-slip condition on rigid boundaries necessitates a correction to the critical value of the Rayleigh-Darcy number for the onset of convection in a horizontal layer of a saturated porous medium uniformly heated from below. It is shown that the use of the Brinkman equation to obtain this correction is not justified, because of the limitations of the equation. These limitations are discussed in detail. An alternative procedure, based on a model in which the porous medium is sandwiched between two fluid layers, and the Beavers-Joseph boundary condition is applied at the interfaces, is described, and an expression for the correction is obtained. It is found that the correction can be of either sign, depending on the relative magnitudes of the parameters involved. (23 refs.)

71643 The use of the variational principle in the solution of Stokes flow problems in fibrous filters. R.C.Brown (Health & Safety Executive, Sheffield, England).
J. Phys. D (GB), vol.16, no.5, p.743-54 (14 May 1983).
The variational principle is applied to trial functions containing infinite series or orthogonal functions, in order to describe Stokes flow through systems with a symmetry too low to permit an exact analytical solution of the flow equation. The problem of Poiseuille flow between two laminae is solved exactly by this method, to illustrate its power. The method is then applied to the problem of flow through a two-dimensional symmetrical fibrous filter, where it results in a many-fibre model of a filter with a continuous stream function, and can be used to calculate the pressure drop across the filter. The model is limited to fibres that are flattened in the flow direction. Finally, the principle is applied to a description of the macroscopic flow pattern through a filter pleat. Reasonable agreement with simple analogue methods is found both for the pressure drop and the flow pattern. (8 refs.)

71644 Kinetics of isothermal evaporation of a porous or dispersed body. B.V.Deryagin, V.M.Starov, D.V.Fedoseev (Inst. of Phys. Chem., Acad. of Sci., USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.900-7 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.265-73 (Aug. 1982). [received: April 1983]
Considers the evaporation of a porous body which consists initially of spheres of identical radii. The authors find the dependence of the velocity of motion of the boundary of the body on the external parameters. (3 refs.)

71645 On the Riemann-Hilbert's boundary value problem, for flow through porous inhomogeneous media. M.T.Orasanu (Vocational School No.3, Bucharest, Rumania).
Mech. Res. Commun. (GB), vol.10, no.1, p.27-36 (Jan.-Feb. 1983).
Previous results concerning Emile Picard's Great Theorem, used for the study of plane, stationary flow with free and seepage surfaces in porous inhomogeneous media of the second type are extended. (6 refs.)

A comparison on the stability of horizontal fluid layers with radiative heat generation for two and three porous plates .... See Entry 71340

Mass transfer and free convection through a porous medium by the presence of a rotating fluid .... See Entry 71543

Statistical study of the grid zone behavior in a shallow gas-solid fluidized bed using a mini-capacitance probe .... See Entry 71629

Diffusional boundary layer resistance for membrane transport .... See Entry 73365

47.60 FLOWS IN DUCTS, CHANNELS, AND CONDUITS

(for biological fluid dynamics, see 87.45)

71646 Regulating valves: the noise problem. I. K.Gruner, R.W.Dam.
Automatie (Netherlands), vol.26, no.12, p.448-58 (Dec. 1982). In Dutch. [received: April 1983]
The mathematical formulae used in calculating the flow of gases, steam, and iquids through pipe restrictions are reviewed. The possible sources of noise from regulating valves are mentioned. Curves are given which show the variation in noise with the pressure drop. In liquids cavitation produces noise while turbulence produces noise in gases. Noise can be reduced by multistage restrictions in valves. (no refs.) *T.S.E.T.*

71647 On the theory of dispersion of a solute during laminar flow in tubes. V.Lisy, L'.Turna (Faculty of Natural Sci., Univ. of P.J. Safarik, Kosice, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.480-4 (1983).
The problem of the diffusion of a solute during laminar flow through a circular tube is solved. A new method of the approximate solution of the corresponding diffusion equation is used. The analytical solution found is compared to previous ones. It is shown that this solution involves the well-known solutions of Taylor-Aris and Maron (1975). The dispersion of a radioactive solute was found which differs from that known in Maron's model. The solution of the problem is also given for the case of the flow between plane parallel walls. (8 refs.)

71648 The dependence of coefficients in the relation of velocity ratio on parameters of a capsule. J.Myska, P.Vlasak (Inst. of Hydrodynamics, Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Chem. Eng. Sci. (GB), vol.38, no.4, p.547-55 (1983).
The velocity of a capsule in a pipeline is usually plotted in most papers in graphs as a dependence of velocity ratio U_k/U on the mean liquid velocity U. In order to compare various velocity measurements there had been derived the equation $U_k/U\text{-}f(U)$ which in general case is hyperbolic containing three parameters. However for evaluation of most published results a simplified linear form of the equation with only two coefficients is good enough. Both empirical coefficients are influenced by parameters of the system like capsule-pipe diameter ratio, capsule-length diameter ratio or apparent density. (9 refs.)

71649 Flow past a thin profile in a channel with permeable working part. N.A.Marevtseva.
Fluid Dyn. (USA), vol.17, no.4, p.644-9 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.180-5 (July-Aug. 1982). [received: April 1983]
An exact solution is obtained to the problem of flow of an ideal incompressible fluid past a thin profile in a straight channel. The channel walls are continuous except for the working part, where they are permeable. (3 refs.)

71650 Density distribution of a molecular stream over surfaces of a vacuum channel. N.K.Nikulin, Yu.A.Nikitchenko.
Izv. VUZ Mashinostr. (USSR), no.3, p.67-71 (1983). In Russian.
Results are presented of investigating the influence of geometric and sorption characteristics of a vacuum channel on density distribution of a molecular stream, admitted in different cross-sections of this channel. The analyses were performed for channels, represented by coaxial cylindrical surfaces, by a method of angular coefficients. Recommendations are made for ensuring a uniform density distribution of the molecular stream in a vacuum channel, evacuated from one end. (5 refs.) *Z.F.V.*

71651 Peristaltic flow of viscoelastic liquids. G.Bohme, R.Friedrich (Inst. fur Stromungslehre und Stromungsmaschinen, Hochschule der Bundeswehr Hamburg, Hamburg, Germany).
J. Fluid Mech. (GB), vol.128, p.109-22 (March 1983).
The mechanism of peristaltic transport of an incompressible viscoelastic fluid by means of an infinite train of sinusoidal waves travelling along the wall of the duct is studied in the case of a plane flow. The main assumptions are that the relevant Reynolds number is small enough to neglect inertia forces, and that the ratio of the wavelength and the channel height is large, which implies that the pressure is constant over the cross-section. For sufficiently small values of the ratio of the wave amplitude and the mean height of the channel, details of the fluid motion are studied analytically within a second-order approximation with respect to the amplitude ratio. Under these conditions the integral constitutive equation of finite linear viscoelasticity is relevant. Particular attention is given to the pressure-discharge characteristics of the peristaltic pump and to the pumping efficiency. The results are influenced by specific values of the complex viscosity of the fluid, which can be determined using standard rheometers. (10 refs.)

71652 Secondary instability of wall-bounded shear flows. S.A.Orszag, A.T.Patera (MIT, Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.128, p.347-85 (March 1983).
An analysis is given of a secondary instability that obtains in a wide class of wall-bounded parallel shear flows, including plane Poiseuille flow, plane Couette flow, flat-plane boundary layers and pipe Poiseuille flow. In these flows it is shown that two-dimensional finite-amplitude waves are (exponentially) unstable to infinitesimal three-dimensional disturbances. This secondary instability seems to be the prototype of transitional instability in these flows in that it has the characteristic (convective) timescales observed in the typical transitions. In the case of plane Poiseuille flow, two-dimensional nonlinear equilibria and quasi-equilibria exist, and the stability of the secondary flow is determined by a three-dimensional linear eigenvalue calculation. In flows without equilibria (e.g. pipe flow), a time-dependent stability analysis is performed by direct spectral numerical calculation of the incompressible three-dimensional Navier-Stokes equations. The energetics and vorticity dynamics of the instability are discussed. (45 refs.)

71653 Simple mathematical model of flow in cylindrical tube system. F.Jirous (CVUT, Praha, Czechoslovakia).
Jad. Energ. (Czechoslovakia), vol.29, no.4, p.121-5 (April 1983). In Czech.
A nonlinear differential equation is derived and numerically solved. It concerns the calculations of flow in the system which is composed of a cylindrical header with a radial or axial inlet, a cylindrical core and a cylindrical header with a radial outlet. In case of symmetrical flow the irregularity flow distribution is determined. (7 refs.)

71654 Inertia effect on deposition of charged particles in a parallel-plate channel. R.Y.Chen, H.E.Pawel, W.C.Chen (N.J. Inst. of Technol., Newark, NJ, USA).
Powder Technol. (Switzerland), vol.34, no.2, p.249-53 (March-April 1983).
The effect of inertia forces on the deposition of highly charged fine particles of sizes less than 20 μm in a parallel-plate channel has been analyzed numerically for uniform and fully-developed flows. The deposition is primarily due to space charge alone and the image and gravity forces are not included in the analysis. A charge-inertia parameter n (ranging from 0 to 1) was defined to characterize the flow deposition phenomena. It was found that for n less than 0.1 the effect of inertia forces may be neglected and that the fraction of deposition near the entrance of the channel deviates substantially from the result neglecting the inertia effect. (5 refs.)

71655 Complementary variational principles for Poiseuille flow of an Oldroyd fluid. M.A.Gopalan (Dept. of Maths., Nat. Coll., Trichy, India).
Proc. Indian Acad. Sci. Math. Sci., vol.91, no.3, p.195-9 (Nov. 1982). [received: May 1983]
The complementary variational principles are given for the Poiseuille flow of an Oldroyd fluid by taking the pressure gradient to be exponentially increasing with time and the bounds on the flux are obtained. (6 refs.)

71656 The hydraulic resistance of a horizontal rectangular channel with stratified two-phase flow. P.V.Besfamil'nyi, A.I.Leont'ev, G.V.Tsiklauri.
Therm. Eng. (GB), vol.29, no.8, p.448-51 (Aug. 1982). Translation of: *Teploenergetika (USSR)*, vol.29, no.8, p.65-7 (Aug. 1982). [received: April 1983]
In designing the flow sections of heat engines and mass transfer apparatus in which there is a wavy liquid film in a carrier flow of gas, calculation of the hydraulic resistance is of great importance. The waves at the surface of the moving film lead to a considerable increase in pressure losses in the channels and, consequently, to an increase in power costs for transporting the medium. Despite the many investigations no reliable universal method of calculation has yet been put forward, due to the strong dependence of the parameters of the wave structure on flow conditions. The authors present the results of investigating hydraulic resistance with cocurrent turbulent air flow and a wavy film in a horizontal duct 2.3 m long, 19 mm high and 165 mm wide. (12 refs.)

71657 Evaluation and calculation of gas flow through axially symmetric tubes. L.Fustoss (Phys. Inst., Tech. Univ. of Budapest, Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.13-16 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
For vacuum techniques, the rate of gas flow is the most important quantity. In the free molecular flow region there are known correct results and approximate formulae for the transmission probabilities. In the near-free molecular flow region Monte-Carlo results and extrapolation terms are available. The precision required or the achievable accuracy determines the complexity of the calculations. For free molecular flow transmission probabilities of axially symmetric tubes a procedure to increase the accuracy is described. In the near-free molecular flow region Monte-Carlo results are presented with an indication of extrapolation possibilities. In the transmission probability calculations allowance is made for the roughness of the tube wall. (9 refs.)

Charge generation in low dielectric constant liquids .... See Entry 71513

Turbulent velocity fluctuations that control mass transfer to a solid boundary .... See Entry 71519

Calculation of turbulent flow of an incompressible fluid in a circular tube with suction through porous walls .... See Entry 71525

Calculation of fully developed turbulent flows in ducts of arbitrary cross-section .... See Entry 71526

Nonsimilar boundary layers on the leeside of cones at incidence .... See Entry 71535

Vibrational thermal convection in a rectangular cavity .... See Entry 71547

Heat transfer in the nonisothermal flow of an anomalously viscous fluid in a helical duct .... See Entry 71554

The velocity perturbations above the orifice of an acoustically excited cavity in grazing flow .... See Entry 71567

Experimental study of mass exchange in axisymmetric cavities .... See Entry 71569

Gravity waves in a channel with a rough bottom .... See Entry 71586

Shocks in gas pipelines .... See Entry 71600

Singular behavior of cavitation in undersaturated water .... See Entry 71616

Cavitation aspects in a Venturi ('Johnsson effects' in a low turbulence flow) .... See Entry 71617

Study of the drag of a throttle in the film boiling of a cryogenic liquid flowing in a horizontal pipe .... See Entry 71632

Ambiguity of the hydrodynamic characteristics (HDC) of boiling channels in cryogenic units .... See Entry 71633

Experimental study of the drag of a two-phase helium flow in channels .... See Entry 71634

Theory and experiment on the three-dimensional motion of a freely suspended spherical particle at the entrance to a pore at low Reynolds number .... See Entry 71637

Dispersed powder flow through vertical pipes .... See Entry 71672

Effect of sedimentation on Taylor diffusion .... See Entry 73375

47.65 MAGNETOHYDRODYNAMICS AND ELECTROHYDRODYNAMICS

(for MHD in plasma, see 52.30)

71658 Instability of horizontal fluid interface in a perpendicular electric field: observational study. H.Terasawa, Y.H.Mori, K.Komotori (Dept. of Mech. Engng., Keio Univ., Yokohama, Japan).
Chem. Eng. Sci. (GB), vol.38, no.4, p.567-73 (1983).
In order to obtain some insight into the potential applicability of electrohydrodynamic augmentation to the direct-contact heat or mass exchange between stratified fluids, observations were made of the phenomena related to the field-induced instabilities at stationary interfaces between air and slightly-conducting oil, slightly-conducting oil and conducting aqueous solution, and two slightly-conducting oils. Established theories assuming the interface conducting or charge-free failed to predict the onset of instability under DC or AC fields in the last fluid system of the three. The geometries and fluid motions at disturbed interfaces are described laying stress on those, found in the last fluid system, which are very peculiar and have not been reported so far. (11 refs.)

71659 Stabilization of bubble-liquid processes by an electric field. V.A.Naletova.
Fluid Dyn. (USA), vol.17, no.4, p.491-7 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.5-12 (July-Aug. 1982). [received: April 1983]
The stability of bubble-liquid and sedimentation processes in the presence of an electric field is investigated. To describe such processes in the case of polarizable particles or bubbles in a dielectric liquid in the presence of an electric field, the 'multivelocity' model of a multiphase mixture interacting with an electric field has been used. Gogosov, Naletova, and Shaposhnikova (1980) have shown that a transition can take place to a regime of uniform ascent or sinking of the particles in the field of a planar capacitor. A criterion of stability of such a regime in an electric field is derived. It is shown that if the electric field is sufficiently strong (stronger than a certain critical E_{cr}) the regime is stable. The stability arises because in a mixture of polarizable phases in the presence of an electric field the difference between the permittivities results in a force F which acts on the disperse phase. (5 refs.)

71660 Flow of a stream containing charged inertial particles past a conducting sphere. O.K.Varentsov.
Fluid Dyn. (USA), vol.17, no.4, p.504-9 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.21-6 (July-Aug. 1982). [received: April 1983]
The problem of the flow of a hydrodynamic stream containing electrically charged particles past a conducting sphere is solved. The influence of the volume density of the electric charge and the potential of the sphere on the capture coefficient η is determined for different values of the inertia parameter of the particles and different drag laws for them. It is shown that for an earthed sphere η can appreciably exceed unity. In the formulation of the problem, it is assumed that the region of electrogasdynamic flow is bounded by two elecrode grids, which simulate the exit of the source of charged particles and the surrounding electric conditions. The velocity field near the sphere is assumed irrotational. The problem is solved numerically. (7 refs.)

71661 Hall effects on nonlinear Hartmann-Ekman layers. K.N.Venkatasiva Murthy (Sri Krishnadevaraya Univ., Anantapur, India).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.841-5 (1983).
Considers the magnetohydrodynamics of a rotating, incompressible, electrically conducting fluid bounded by a single infinite insulating disk, subjected to a differential rotation. The magnetic field is sufficiently large and the motion of the charged particles across the magnetic field is hindered resulting in the existence of Hall currents in a direction perpendicular to both electric and magnetic fields. These Hall currents arise in several astrophysical situations and in MHD power generation. Taking the Hall currents into consideration, a nonlinear theory of the hydromagnetic flow problem has been developed using the method of matched asymptotic expansions. The Hall currents are shown to produce several important and interesting effects on the thickness of the boundary layers like controlling suction velocity at the outer edge of the magnetic diffusion region and eliminating the occurence of negative rotational velocity at the transitional edge of the two boundary layers. (4 refs.)

71662 Electrohydrodynamic generator, a study of short-circuit current in relation to the length between the injector and the collector and to the liquid temperature. G.Touchard, A.Il Idrissi, P.Humeau (Lab. of Phys. & Fluid Mech., Univ. of Poitiers, Poitiers, France), J.Sauniere.
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.71-9
The study concerns the dependence of the current delivered by an electrohydrodynamic generator on two parameters: the temperature of the dielectric liquid and the length of the insulating tube which separates the collector reservoir from the capillaries. Under constant liquid flow, the current increases with temperature, its value doubling when the temperature is raised from 30°C to 50°C. The influence of the length of insulating tube is such that maximum current is obtained when the length is shortest, thus confirming the theory that was proposed. (7 refs.)

Flow of electrically charged aerosols past bodies .... See Entry 71631

Hydromagnetic waves in a differentially rotating sphere .... See Entry 73720

Energy dynamics in stressed magnetic fields: the filamentation and flare instabilities .... See Entry 73983

47.70 REACTIVE, RADIATIVE, OR NONEQUILIBRIUM FLOWS

71663 Flame spread in an opposed flow with a linear velocity gradient. I.S.Wichman (Dept. of Mech. & Aerospace Engng., Princeton Univ., Princeton, NJ, USA).
Combust. & Flame (USA), vol.50, no.3, p.287-304 (April 1983).
A theoretical model is developed for estimating the rate of flame spread under conditions of heat-transfer control with account taken of the fact that the gas velocity is not uniform. It is shown that the functional dependence of the spread rate on parameters such as the external gas velocity is modified from that obtained in the classical study of J.N. de Ris (1969). The modified formula is capable of lending interpretation to previously anomalous experimental observations. (12 refs.)

71664 A composite model for the conserved scalar PDF [of turbulent reacting flows]. E.Effelsberg, N.Peters (Inst. fur Allgemeine Mech., Rheinisch-Westfalische Tech. Hochschule Aachen, Aachen, Germany).
Combust. & Flame (USA), vol.50, no.3, p.351-60 (April 1983).
A parametric expression for the conserved scalar probability density function (PDF) is derived on the basis of a physical interpretation of the turbulent signal. The scalar signal is split into three parts: a fully turbulent part, a superlayer part, and a outer flow part. Each part is represented by a different form of the PDF. The composite PDF which is obtained by adding these parts together has four parameters in addition to the intermittency factor. It can be integrated so that algebraic relations between these parameters and the first four moments are obtained. Application of the formulation to J.C. LaRue's and P.A. Libby's measurements (1974) in the plane turbulent wake indicates the existence of transitions that are interpreted as internal superlayers far inside the turbulent flow. (16 refs.)

71665 Hydrodynamics of films of surface-active substances. N.G.Taktarov.
Fluid Dyn. (USA), vol.17, no.4, p.612-18 (July-Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Zhidk. & Gaza*, vol.17, no.4, p.150-7 (July-Aug. 1982). [received: April 1983]
The author derives equations describing the motion of a film of surface-active substance at the interface of two three-dimensional phases. The film is assumed to consist of m two-dimensional phases and n components that react chemically with one another. The three-dimensional phases are assumed to be single phases and consist of n components, which can be adsorbed and desorbed at the interface. The interface exchanges matter, momentum, and energy with the three-dimensional phases and is thus an open system. Using the methods of the thermodynamics of nonequilibrium processes, the author obtains expressions for the two-dimensional stress tensors of all phases the diffusion fluxes of the surface-active substance in the two-dimensional phases, the heat fluxes within the phases and the heat transfer between the phases, the rates of the surface chemical reactions and the two-dimensional phase transitions. (18 refs.)

Equation of equilibrium emission and retardation parameters in nuclear-power-plant turbines with dissociating nitrogen tetroxide .... See Entry 70712

Calculation of gas flow in a Laval nozzle in the presence of nonequilibrium physiocochemical processes .... See Entry 71623

The induction period of a thermal explosion in a gas between infinite parallel plates .... See Entry 73336

Sensitivity analysis for premixed, laminar, steady state flames .... See Entry 73338

47.75 RELATIVISTIC FLUID DYNAMICS

71666 Some remarks on conservative symmetric-hyperbolic systems governing relativistic theories. A.Strumia (Istituto di Matematica Applicata, Univ. di Bologna, Bologna, Italy).
Ann. Inst. Henri Poincare Sect. A (France), vol.38, no.2, p.113-20 (1983).
It is shown that for the covariant quasi-linear hyperbolic systems of conservation laws, endowed with a supplementary balance equation, which exhibit a special structure, some results obtained in a previous paper can be proved in a simpler way by choosing a field dependent congruence as time direction instead of a field independent fourvector. In the case of fluid dynamics it is shown that the suitable congruence is represented by the fluid fourvelocity. (6 refs.)

Conservation form, in general non steady coordinates, of the Navier-Stokes equations and boundary conditions for a moving boundary problem .... See Entry 71511

47.80 INSTRUMENTATION FOR FLUID DYNAMICS

71667 Visualization of multijet impingement flow. K.R.Saripalli (McDonnell Douglas Corp., St. Louis, MO, USA).
AIAA J. (USA), vol.21, no.4, p.483-4 (April 1983).
Flow visualization experiments were conducted in water as the working medium to study multijet impingement flows with fountain formation. The visualization technique uses fluorescein-sodium, a fluorescent dye, as tracer fluid and illumination by a sheet of light obtained by spreading a laser beam. Streakline photographs were also taken using air bubbles as tracer particles. Stagnation-line patterns were recorded for the cases of two-, three-, and four-jet configurations and compared with theoretical predictions. (3 refs.)

71668 An air flow rig for use in hot element and other anemometer experiments. M.J.Turner (Dept. of Electrical Engng., Univ. of the Witwatersrand, Johannesburg, S Africa).
Int. J. Electr. Eng. Educ. (GB), vol.20, no.2, p.169-76 (April 1983).
An apparatus used in undergraduate instrumentation teaching is described. A small wind tunnel creates air speeds up to 12 m/s. A pitot tube is used as a reference against which a hot wire anemometer is compared for linearity and transient response. The experiment serves to introduce non-ideal systems. (2 refs.)

71669 Steady shallow flow over curved beds. N.S.Sivakumaran, T.Tingsanchali, R.J.Hosking (Asian Inst. of Technol., Bangkok, Thailand).
J. Fluid Mech. (GB), vol.128, p.469-87 (March 1983).
The validity of recent shallow-flow equations with bed curvature is examined. Subcritical, critical and supercritical steady-flow solutions are identified, and the point of critical flow on the bed located, in terms of a generalized Froude number. Experiments on steady flow over both a symmetric and unsymmetric bed profile show that the theory satisfactorily predicts the free-surface and bed-pressure profiles over $-2 \lesssim \kappa h \leq 0.54$ (where κ is the bed curvature and h is the flow depth normal to the bed). (11 refs.)

71670 Method of obtaining stable flow rates in test systems. V.B.Korolev, L.M.Korsunskii, A.F.Semenchenko.
Meas. Tech. (USA), vol.25, no.8, p.650-1 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.26-7 (Aug. 1982). [received: April 1983]
In systems for checking and calibrating flowmeters and devices measuring local velocity and velocity fluctuation it is necessary to provide stable flows with reproducible hydrodynamic characteristics. A method of stabilizing the flow rate by means of an automatic-control system with feedback from the flow rate and electromagnetic flowmeters of elevated accuracy as transducers in a test system employing a free jet for examining and calibrating velocity-fluctuation meters is considered. The system provides control of the speed at the nozzle over the range 1:200. (3 refs.)

71671 Calibration of a jet flowmeter on a substitute liquid. V.M.Levin.
Meas. Tech. (USA), vol.25, no.8, p.652-3 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.28-9 (Aug. 1982). [received: April 1983]
Specialized jet flowmeters for liquid Freon have been considered. The jet method of measurement consists in using the impact pressure arising on contact between a jet emerging from a nozzle and a baffle as the flow-rate signal. The theory of calibration on a substitute liquid is presented and practical verification of the theoretical formulas is discussed. It is concluded that the jet method of flow rate measurement is promising for liquids for which direct calibration is difficult. (2 refs.)

71672 Dispersed powder flow through vertical pipes. G.A.Irons, J.-S.Chang (McMaster Univ., Hamilton, Ontario, Canada).
Powder Technol. (Switzerland), vol.34, no.2, p.233-42 (March-April 1983).
A novel transducer, based on an electrical capacitance principle, was used to measure the instantaneous volume-averaged in situ particle fraction and thereby determine the volume-averaged particle velocities. It was clear that the 450 μm diameter sand particles were being accelerated to a terminal slip velocity with respect to the gas phase. The static pressure drop over the same length was also measured and interpreted by means of a one-dimensional, two-phase model. The contributions to the overall pressure drop of gravitational forces on the particle, acceleration of gas and particles and the coupling force between gas and particles were calculated. The gas-particle drag coefficients were within 30% of those of single particles. A predictive model was also developed which yielded good results with the experimental data. (7 refs.)

71673 Non-intrusive measurement of aerodynamic flow.
Rev. Polytech. (Switzerland), no.3, p.201, 203 (1983). In French.
Describes a laser-based flow meter devised by the Office National d'Etudes et de Recherches (ONERA) for non-intrusive measurement of rates of flow at for example transonic and supersonic velocities, in hot gases up to 2700°C, etc. Two laser beams at slightly different frequencies are arranged to cross so as to produce a space, situated in the flow, and of the order of 20 μm dia. and 800 μm length, in which there is a system of moving interference fringes. Sub-microscopic particles (typically of incense smoke, dioctylephtalate, ZrO_2, TiO_2, etc.) are injected into the flow and are detected during their passage through the fringes by two photomultipliers with suitable filters; the resulting information is processed to provide a linear indication of the velocity and to indicate turbulence of velocity, with accuracy of the order of 1%. (no refs.)
C.J.O.G.

A new fast neutron scattering technique for local void fraction measurement in two-phase flow .... See Entry 70714

The dynamics of double-diffusive gravity currents .... See Entry 71551

The effects of yaw and finite length upon the vortex wakes of stationary and vibrating circular cylinders .... See Entry 71559

Interference between two circular cylinders forming a cross .... See Entry 71560

Flow near a vibrating cylinder .... See Entry 71564

The flow between two finite rotating disks enclosed by a cylinder .... See Entry 71566

Experimental study of mass exchange in axisymmetric cavities .... See Entry 71569

Gravity currents with variable inflow .... See Entry 71581

High resolution submillimeter-wave radiometry of supersonic flow .... See Entry 71593

Experimental investigation of flow rate and thrust characteristics of a four-nozzle ejector with swirling flow .... See Entry 71624

The kinematics of stratified mixing through internal wavebreaking .... See Entry 71627

Internal mixing in stratified fluids .... See Entry 71628

50.00 FLUIDS, PLASMAS AND ELECTRIC DISCHARGES

(for fluid dynamics, see 47.; for the physics of condensed matter, see 60. and 70.)

51.00 KINETIC AND TRANSPORT THEORY OF FLUIDS; PHYSICAL PROPERTIES OF GASES

51.10 KINETIC AND TRANSPORT THEORY

71674 A rough-hard-sphere theory for diffusion in supercritical carbon dioxide. S.-H.Chen (Dept. of Chem. Engng., Univ. of Rochester, Rochester, NY, USA).
Chem. Eng. Sci. (GB), vol.38, no.4, p.655-60 (1983).
A rough-hard-sphere (RHS) theory is found to successfully account for the effects of molecular rotation and dynamically correlated molecular collisions on self-diffusion in carbon dioxide at temperatures from 35 to 100°C and pressures from 70 to 246 atm. The Mathur-Thodos empirical equation finds its molecular basis within the framework of the RHS theory. The theory is also applicable to tracer diffusion of benzene in carbon dioxide at 35-55°C and 91-158 atm, where densities are greater than 0.500 g/cm^3. Its failure at lower densities suggests that the molecular dynamics computer result of self-diffusion is inadequate for describing the effect of collective molecular motion encountered in tracer diffusion across the entire density range. Further computer work is recommended which will refine the prediction of tracer diffusion in supercritical fluids using the RHS theory. (25 refs.)

71675 Development of a new correlation for binary gas phase diffusion coefficients. P.C.Singh (Dept. of Chem. Engng., Auburn Univ., AL, USA), S.Singh.
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.2, p.123-40 (March-April 1983).
In the present investigation a simple and widely applicable correlation for the estimation of binary gas phase diffusion coefficient has been developed. The correlation needs only well known parameters and therefore is easier to use in comparison with other correlations available which need parameters and factors not known for many substances and therefore need experimental determination first. (22 refs.)

71676 Excess second virial coefficients for nitromethane and cyclohexane at 373.2K and nitroethane and cyclohexane at 298.25, 323.16 and 348.38K. K.N.Marsh, H.P.D.Rogers (Dept. of Chem., Univ. of New England, Armidale, NSW, Australia).
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.1, p.1-4 (Feb. 1983).
The excess second virial coefficients of nitromethane and cyclohexane at 373.2K and nitroethane and cyclohexane at 298.25, 323.16 and 348.38K have been measured by use of a differential technique. The excess second virial coefficients are large and positive. The results for both pure nitromethane and the mixtures are satisfactorily predicted by the correlation proposed by J.G. Hayden and J.P. O'Connell (1975). (11 refs.)

71677 Generalized treatment of self-diffusivity for the gaseous and liquid states of fluids. H.Lee, G.Thodos (Northwestern Univ., Evanston, IL, USA).
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.1, p.17-26 (Feb. 1983).
Self-diffusivity measurements reported in the literature for 27 fluids have been critically reviewed and used to develop a method for predicting this transport property for all fluid conditions including the liquid state. In this treatment, a dimensional analysis produced the self-diffusivity parameter, $\delta = M^{1/2}/P_c{}^{1/2}v_c{}^{5/6}$, which, with the exception of helium-3, permitted the development of a unique relationship between $\mathcal{D}\delta/T_R$ vs. ρ_R for reduced densities, $\rho_R<1.0$. For $\rho_R>1.0$, the dimensionless ratio $G=(X^*-X)/(X^*-1)$ has been adopted for a generalized treatment with $\mathcal{D}\delta/T_R$ where $X=\rho_R/T_R{}^{0.1}$, and which becomes constant along the solid melting curve to define X2u at the triple-point temperature. (94 refs.)

71678 Statistical mechanics of one-dimensional systems. III. Multicomponent gas with Kac's potential. T.Takano, K.Ikeda (Dept. of Appl. Phys., Osaka Univ., Suita, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.415-30 (Feb. 1983).
For pt.II see ibid., vol.67, no.6, p.1678-86 (1982). The model of one-dimensional multicomponent gas is considered in which the particles have hard cores and the (attractive) interparticle potentials are given by $-a_{ij}\gamma e^{-\gamma R}$ with $\gamma \rightarrow +0$ (a_{ij} being a positive constant characteristic of the pair i, j of species). By the method of external potential, an equation for the grand partition function for this model is obtained. By finding the largest eigenvalue of this equation, the pressure and all the other thermodynamic functions for the infinite system are exactly calculated. It is shown that this model exactly obeys the same equation of state as the one obtained in the preceding paper of this series, i.e. the natural extension of van der Waals' equation of state to the multicomponent system. (10 refs.)

71679 Analytical solutions for infrared-laser driven diffusion in polyatomic gas mixtures. N.M.Lawandy, E.W.Cumming (Div. of Engng., Brown Univ., Providence, RI, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2548-54 (May 1983).
The authors use an effective bimodal velocity distribution in a five-level model to analytically examine the problem of laser-driven gas transport in mixtures of an absorbing gas and a buffer gas. Analytic expressions are given for the steady-state active-gas density distribution in a closed tube for a uniform excitation profile. The model also predicts that laser induced transport may occur without a buffer gas if collision favoring simultaneous vibrational deactivation and velocity change occur. Profiles are given for CH_3F:He mixtures when a CO_2 laser is used to excite the $Q_{12,2}$, ν_3 band absorption. (17 refs.)

Pressure dependence of ^1H and ^{19}F chemical shifts in 1,1-difluoroethylene gas and in gaseous mixtures .... See Entry 70916

On the dynamics in compressed methane gas at 3 kbar by inelastic neutron scattering .... See Entry 70989

Dependence of tagged-particle motion on size and mass .... See Entry 71606

Theoretical studies of H_2-H_2 collisions. IV. Ab initio calculations of anisotropic transport phenomena in parahydrogen gas .... See Entry 71682

51.20 VISCOSITY AND DIFFUSION: EXPERIMENTAL

71680 The transverse diffusion of mass-identified N_2^+ ions in nitrogen. G.Sejkora, T.D.Mark (Abteilung fur Kernphys. und Gaselektronik, Leopold Franzens Univ., Innsbruck, Austria).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.123-6 (6 May 1983).
A new apparatus suitable for the quantitative study of the transverse diffusion of mass identified ions is described. Measurements of the transverse diffusion of N_2^+ in nitrogen are reported and comparison is made with other data. (10 refs.)

Generalized treatment of self-diffusivity for the gaseous and liquid states of fluids .... See Entry 71677

Exchange of H_2S between air and water .... See Entry 73840

51.30 THERMAL PROPERTIES OF GASES

71681 Prediction of transport properties. II. Thermal conductivity of pure fluids and mixtures. J.F.Ely, H.J.M.Hanley (Nat. Engng. Lab., NBS, Boulder, CO, USA).
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.1, p.90-7 (Feb. 1983).
For pt.I see ibid., vol.20, p.323 (1981). A technique for the prediction of the thermal conductivity of nonpolar pure fluids and mixtures over the entire range of *PVT* states is presented. Calculations for the thermal conductivity require only critical constants, molecular weight, Pitzer's acentric factor, and the ideal gas heat capacity as a function of temperature for each mixture component as input. Extensive comparisons with experimental data for pure fluids and nonpolar binary fluid mixtures including paraffins, alkenes, aromatics and naphthenes with molecular weights to that of C_{24} are presented. The average absolute deviation between experiment and prediction is less than 7% for both pure species and mixtures. (84 refs.)

71682 Theoretical studies of H_2-H_2 collisions. IV. Ab initio calculations of anisotropic transport phenomena in parahydrogen gas. W.E.Kohler (Inst. fur Theoretische Phys., Univ. Erlangen-Nurnberg, Erlangen, Germany), J.Schaefer.
J. Chem. Phys. (USA), vol.78, no.8, p.4862-74 (15 April 1983).
The temperature dependence of the effective Waldmann-Snider cross sections determining the Senftleben-Beenakker effects of viscosity and heat conductivity has been studied for pH_2 gas between 10 and 200K. From ab initio nonspherical potentials of H_2-H_2, scattering matrices have been determined in close-coupling calculations. From these, the elements of the scattering amplitude matrix have been obtained and used as input quantities for the evaluation of the various Waldmann-Snider collision integrals. The results of these first ab initio numerical calculations of anisotropic transport coefficients show excellent agreement of calculated and measured effective cross sections, especially for the most recent improved version of the interaction potential. In addition, it has been shown that the polarization production cross sections are quite sensitive to the potential anisotropy. (36 refs.)

71683 Two-dimensional Gaussian core model at high temperature. F.H.Stillinger, T.A.Weber (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2642-8 (May 1983).
The two-dimensional Gaussian core model in the high-temperature regime has been examined by two means: (1) exact high-temperature series, and (2) molecular-dynamics simulation. The former diverge but can be summed by Borel transforms. Evidence is offered that in the case of the mean potential energy per particle and the excess pressure that the Borel transforms are analytic throughout the complex plane. Furthermore, these transforms grow exponentially along the positive real axis at a rate which determines the fluid's freezing-point temperature. Approximate Borel transforms have been constructed which fit the simulation data adequately. (10 refs.)

51.50 ELECTRICAL PHENOMENA IN GASES

(see also 52. Plasma and electric discharges)

71684 A study on the measurement of electron drift velocity in metal vapour. Yontack Chung, Sung-Chul Ha.
Trans. Korean Inst. Electr. Eng., vol.31, no.12, p.206-16 (1982). In Korean.
Results are presented from an experimental study of the electron drift velocity in the K vapor on the open end heat pipe system by the inducing current method and spectroscopic measuring system. The test conditions were pressure of 3.6 to 20.1 Torr., temperature of 667 to 775K, and E/N of 10^{-16} to 10^{-15} V cm^2. The results of this study are obtained essentially the same as the extrapolated prediction curve for electron drift Velocity in the K vapor of Nakamura et al with range of E/N 10^{-17} to 10^{-16} V cm^2 and the electron drift velocity is decreased about 30% over all range which is less than that of the Na vapor. (12 refs.)

71685 Dependence of electrical conductivity of SF_6 on temperature and pressure in a strong electric field. P.Krenek (Ustav pro Elektrotech. CSAV, Prague, Czechoslovakia).
Elektrotech. Obz. (Czechoslovakia), vol.72, no.3, p.139-43 (March 1983). In Czech.
An algorithm for the calculation of electrical conductivity of a mixture of partially ionised gases is proposed based on considerations about the dependence of the electron mobility and temperature on the intensity of electric field which respects the dependence of the mixture composition on the electron temperature. The calculations were applied to the mixture of products of the decomposition of SF_6 in order to determine the dependence of the electron conductivity on pressure in a strong electric field. (9 refs.)

71686 A modified constriction model for the resistivity of a bubble curtain on a gas evolving electrode. O.Lanzi, R.F.Savinell (Dept. of Chem. Engng., Univ. of Akron, Akron, OH, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.799-802 (April 1983).
At gas evolving electrodes, the bubble curtain at the electrode surface contributes to the voltaic inefficiencies of the electrolyzer. Consequently, the structure of the bubble curtain and its effect on electrolyte resistivity is of practical importance. In order to predict the resistance of the bubble curtain several models have been suggested in the literature. Three-dimensional models pro-

vide an adequate prediction of the resistance of dilute bubble curtains with monolayer gas voidages less than 0.55. The authors propose a two-dimensional constriction model of a dense bubble curtain which is modified to account for a three-dimensional dispersed phase within the monolayer. The resulting mathematical expression behaves properly in the limits of voidage and its prediction agrees well with the limited available data. (14 refs.)

Absorption waves in gases .... See Entry 71601

The ionisation coefficient in Ar-Hg mixtures .... See Entry 71825

Ionisation and attachment in binary mixtures of SF_6-N_2 and CCl_2F_2-N_2 .... See Entry 71826

51.60 MAGNETIC PHENOMENA IN GASES

(for liquids, see 75.)

Theoretical studies of H_2-H_2 collisions. IV. Ab initio calculations of anisotropic transport phenomena in parahydrogen gas .... See Entry 71682

51.70 OPTICAL PHENOMENA IN GASES

(for liquids, see 78.)

71687 A relation between Holstein's photon escape transmission factor and the equivalent width. B.H.Armstrong (IBM Sci. Center, Palo Alto, CA, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.561-2 (June 1983).
It is shown that the photon escape transmission factor for a spectrum line in a homogeneous gas, defined by Holstein in his study of the imprisonment of resonance radiation, is a useful derivative of the equivalent width or total absorption of the line. (12 refs.)

Note on 'Spin-weighted spherical harmonics and electromagnetic multipole expansions' .... See Entry 69826

The temperature dependence of the Cotton-Mouton effect of ethane, ethene and ethyne .... See Entry 70959

Absorption waves in gases .... See Entry 71601

52.00 THE PHYSICS OF PLASMAS AND ELECTRIC DISCHARGES

(for solid-state plasma, see 72.30)

52.20 ELEMENTARY PROCESSES IN PLASMA

Vibrational kinetics in He-CO reacting discharges .... See Entry 70858

On the conductance theory of plasmas .... See Entry 71694

An efficient numerical method for time-dependent NLTE radiation transfer .... See Entry 71703

Magnetoplasma lamination due to microwave gyroresonant heating .... See Entry 71754

Stellarators .... See Entry 71784

52.20F Electron collisions

71688 Shifts of ionized-helium lines from electron collisions in dense plasmas. H.R.Griem (Lab. for Plasma, Univ. of Maryland, College Park, MD, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2566-76 (May 1983).
The semiclassical impact-parameter method is used to calculate shifts of ionized helium lines in the first three spectral series caused by electrons in a plasma. These shift together with opposite and smaller shifts due to ion quadrupole interactions are in agreement with observed shifts of lines corresponding to the Paschen series of hydrogen. Adding plasma polarization shifts according to the linearized Debye model to the shifts calculated here results in overestimates by a factor of 2 for the shifts of these lines. For lines corresponding to the Balmer series such addition may be consistent with measurements, while for the Lyman series all present theoretical models are found inadequate. (23 refs.)

Experiments with pure electron plasmas .... See Entry 71700

52.20H Atomic, molecular, heavy-particle collisions

71689 Numerical study of overpopulation density for laser oscillation in recombining hydrogen plasmas. T.Oda (Faculty of Sci., Hiroshima Univ., Hiroshima, Japan), U.Furukane.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.553-9 (June 1983).
Overpopulation densities Δn_{ij}, which are defined as the differences between the population densities per unit statistical weight of the upper and lower excited levels i and j, are calculated as a function of the electron density n_e for various electron temperatures T_e in recombining hydrogen plasmas. Calculations have been made for line pairs with principal quantum numbers (2,3), (3,4) and (4,5). The effect of the ground-level population density n_1 on Δn_{ij} is calculated. In this calculation, the atom-atom collision and the self-absorption of the resonance lines are taken into account. The n_1-dependence of Δn_{ij} remains almost constant until the self-absorption becomes significant. The threshold condition for laser oscillation is discussed in relation to the calculated Δn_{ij}. Laser oscillation is possible for the line pair (2,3) at an electron density and temperature higher than for the other pairs (3,4) and (4,5) when self-absorption is negligible. (21 refs.)

52.25 PLASMA BASIC PROPERTIES

71690 'Pair correlations and internal energy of the two-dimensional Coulomb gas'. J.P.Hansen, P.Viot (Lab. de Phys. Theorique des Liquides, Univ. Pierre et Marie Curie, Paris, France).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.155-8 (25 April 1983).
The authors examine the pair correlations and the thermodynamic properties of the classical two-component plasma in two dimensions within the Poisson-Boltzmann and HNC approximations. (10 refs.)

71691 Integral-equation method for electric microfield distributions. C.A.Iglesias (Dept. of Phys., Univ. of Florida, Gainesville, FL, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2705-9 (May 1983).
The Fourier transform of the electric microfield distribution function is expressed, without approximations, in terms of a two-body function. The two-body function may be interpreted as a 'generalized' radial distribution function and therefore is amenable to integral-equation techniques. In particular, the formalism is shown to simplify considerably in the hypernetted-chain approximation. (16 refs.)

On the conductance theory of plasmas .... See Entry 71694

Retardation length of charged particlese in a high temperature plasma .... See Entry 71695

Electrical conductivity for radio-frequency fields in strongly magnetized plasmas with density fluctuations .... See Entry 71696

On reflexion and trapping of upper-hybrid waves .... See Entry 71719

The thermal self-focusing of a wave beam in an under dense plasma. I. The wave spectrum .... See Entry 71724

Parametric excitation of the drift wave by a modulated ion beam .... See Entry 71727

Early history .... See Entry 71730

Tokamak plasma stability .... See Entry 71731

The ponderomotive force and magnetic field generation effects resulting from the non-linear interaction between plasma-wave and particles .... See Entry 71736

The 'super-reflection' effect during the interaction of high power radiation with moving plasma .... See Entry 71740

Dynamics of heavy particles close to a negatively charged wall in a dense fully ionized plasma .... See Entry 71747

Plasma boundary layer in limiter and divertor Tokamaks .... See Entry 71749

Physics of REB-plasma interaction .... See Entry 71753

The interaction of carbon dioxide laser radiation with a pulsed vacuum arc .... See Entry 71761

Observation of Stark-shifts of Lyman-α lines of low-Z ions in laser-produced plasmas .... See Entry 71762

Determination of the runaway-electron distribution function by cyclotron absorption in a Tokamak .... See Entry 71766

Plasma formation in a gas-liner pinch .... See Entry 71773

Plasma density measurements in a fast linear theta-pinch by absolute intensity measurements of bremsstrahlung .... See Entry 71793

Electron temperature measurement by Thomson scattering in Tokamak NOVA II .... See Entry 71797

Temperature measurement of an N_2 glow discharge by emission spectroscopy .... See Entry 71798

Plasma boundary diagnostics by laser induced fluorescence .... See Entry 71799

Density fluctuation measurement by infrared light scattering .... See Entry 71800

Characteristics of a transferred-arc plasma .... See Entry 71809

Analysis of the kinetic properties and the energy budget of the electrons in the Ar-Hg glow discharge plasma at varying partial pressures and discharge currents .... See Entry 71813

The construction of systems of equations describing gas discharges containing several species of atoms and ions, including stepwise processes, negative ions, and the spatial variation of the temperatures .... See Entry 71814

Departures from CLTE composition in a nitrogen arc at atmospheric pressure. I. Experimental results .... See Entry 71828

Departures from CLTE composition in a nitrogen arc at atmospheric pressure. II. Interpretation of departures from CLTE .... See Entry 71829

Lamp model equations taking into account the radial temperature profile of arc plasma .... See Entry 71830

Stability of an astrophysical plasma near the onset of electron runaway .... See Entry 73989

52.25F Transport properties

71692 Plasma—Particle momentum and heat transfer: modelling and measurements. M.Vardelle, A.Vardelle, P.Fauchais (Univ. de Limoges, Limoges, France), M.I.Boulos.
AIChE J. (USA), vol.29, no.2, p.236-43 (March 1983).
Measurements were made of the two-dimensional flow and temperature field in a DC plasma jet under different operating conditions. The particle velocity and the in-flight particle temperature were also measured for narrow cuts of alumina powders, of mean particle diameters of 18, 23, 39 and 46 μm, injected in the jet. The results are compared with the predictions of a one-dimensional mathematical model. The measured and computed particle velocities are in good agreement. This is, however, not the case for the particle temperature where considerable differences are observed. An attempt is made to determine the parameters which are often unduly neglected in modelling work and to identify the areas where further work is needed. (18 refs.)

71693 Stochastic current driven by a wave. Xia Meng-fen (Inst. of Theoretical Phys., Peking Univ., Peking, China).
Acta Phys. Sin. (China), vol.32, no.3, p.338-45 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
A new mechanism of current driven by a wave is discussed. There is a series of resonant regions in the velocity space of a magnetized plasma interacting with a single wave. When the amplitude of the wave is higher than a threshold, some of the resonant regions will overlap each other and the stochastic effect will appear. If the overlapping region is asymmetric in the longitudinal velocity distribution of the electrons, the plasma current may be driven by the wave as a result of the stochastic effect. (11 refs.)

71694 On the conductance theory of plasmas. W.D.Kraeft, J.Blumlein, T.Meyer (Sektion Phys./Elektronik, Ernst-Moritz-Arndt-Univ., Greifswald, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.1, p.9-24 (1983).
In the framework of the linear response theory a quantumstatistical expression for the conductivity of nonideal plasmas is derived. In a simple approximation the influence of electron-ion scattering and that of masses of equal magnitude on the conductivity is discussed; the latter is expressed in terms of transport collision frequencies. (35 refs.)

71695 Retardation length of charged particlese in a high temperature plasma. S.V.Bozhokin, E.A.Choban.
Fiz. Plazmy (USSR), vol.9, no.2, p.412-19 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
Energy losses of charged particles in a high temperature plasma are calculated using dielectric penetration in a random phase approximation in which effects of degeneracy of the electron subsystem are significant. An expression is derived for the retardation length of a test particle, in which a correction to the Coulomb logarithm is taken into account, dependent on the velocity of the test particle. The retardation length of protons, tritons and alpha-particles are calculated for braking in high temperature plasma taking into account degeneracy of the electron subsystem. It is shown that for plasma with a temperature of O-0.5 keV and a density of $n \sim 10^{13}$-10^{24} cm^{-3} previous results for the retardation length are too low by ~3-5 times. (24 refs.) *A.G.C.*

71696 Electrical conductivity for radio-frequency fields in strongly magnetized plasmas with density fluctuations. Yu.S.Sayasov, Ch.P.Ritz (Dept. of Phys., Univ. of Fribourg, Fribourg, Switzerland).
J. Plasma Phys. (GB), vol.29, pt.2, p.299-315 (April 1983).
A general investigation of the electrical conductivity for radio-frequency (RF) fields in strongly magnetized plasmas with small-scale density fluctuations is performed within the cold plasma hydrodynamical approximation. It is shown that in such plasmas an RF phenomenon similar to the Bohm diffusion exists: the presence of stochastic RF electric field in a turbulent plasma can lead to a strong enhancement of the RF currents flowing in the direction of the applied electric field components transverse to the magnetic field. The appearance of these turbulent drift currents favours energy transfer from the RF fields to the plasma and thus leads to their stronger damping. This effect allows the authors to interpret quantitatively the enhanced damping of the magnetosonic waves observed in several experiments. The magnetized radially inhomogeneous cylindrical plasmas in these experiments are characterized by density fluctuations due to drift instabilities. The theory has also a number of other applications; an example is given of the whistlers damped by the ionospheric density fluctuations. (21 refs.)

71697 General solution of the Clemmow equation in a three-dimensional cold plasma, with a zero-velocity stream. J.Blandin, R.Pons, J.Skinazi (Phys. Theorique des Plasmas, Univ. Pierre et Marie Curie, Paris, France), G.Marcilhacy.
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.33-8 (14 May 1983).
The authors derive explicitly the general solution of Clemmow's electron reduced velocity equation (1974) for wave propagation of extremely large amplitude in a cold collisionless two-component plasma. (6 refs.)

71698 Doppler shift and ion mobility measurements of ArH^+ in a He DC glow discharge by infrared laser spectroscopy. N.N.Haese, Fu-Shih Pan, T.Oka (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1575-8 (16 May 1983).
A new, infrared-laser-spectroscopic method for in situ ion drift-velocity and mobility measurements in a DC glow discharge is reported, a method sensitive to quantum effects in the ion transport process. Excellent agreement with earlier drift-tube studies for the mobility of ArH^+ in He is obtained. While no ion rotational energy dependence was observed in preliminary measurements, a vibrational dependence was suggested. (22 refs.)

71699 Magnetic field line reconnection experiments. W.Gekelman, R.L.Stenzel, N.Wild (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.277-87 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
A laboratory experiment concerned with the basic physics of magnetic field line reconnection is discussed. Stimulated by important processes in space plasmas and anomalous transport in fusion plasmas the work addresses the following topics: dynamic magnetic fields in a high beta plasma, magnetic turbulence, plasma dynamics and energy transport. First, the formation of magnetic neutral sheets, tearing and island coalescence are shown. Nonstationary magnetic fluctuations are statistically evaluated displaying the correlation tensor $\langle \mathbf{BB} \rangle$ in the ω-$\mathbf{k}$ domain for mode identification. Then, the plasma properties are analyzed with particular emphasis on transport processes. Although the classical fluid flow across the separatrix can be observed, the fluctuation processes strongly modify the plasma dynamics. Direct measurements of the fluid force density and ion acceleration indicate the presence of an anomalous scattering process characterized by an effective scattering tensor ν^*. Turbulence also enhances the plasma resistivity η^* by one to two orders of magnitude. (60 refs.)

71700 Experiments with pure electron plasmas. J.H.Malmberg, C.F.Driscoll, W.D.White (Dept. of Phys., Univ. of California, San Diego, La Jolla, CA, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.288-92 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
Pure electron plasmas are one of the simplest systems on which plasma wave and transport effects can be studied. Two recent experiments on this system are discussed. The loss of electrons due to anomalous transport has been measured over a six order of magnitude variation in containment time. The containment time scales approximately as $[\text{magnetic field/plasma length}]^2$. The growth of the $l=1$ diocotron wave due to resistance between sections of the bounding wall has been observed. The measured growth rates agree with theory. (15 refs.)

71701 Lower hybrid current derive and sustainment in WT-2 Tokamak. S.Tanaka, Y.Terumichi (Dept. of Phys., Faculty of Sci., Kyoto Univ., Kyoto, Japan).
Phys. Scr. (Sweden), vol.T2, no.2, p.423-7 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The lower hybrid current drive experiments have been carried out in the WT-2 Tokamak. The RF power P_{rf} is injected near the end of Tokamak discharge by the four waveguides array. The plasma can be sustained by the RF driven current only during the RF injection period. The scaling of the RF driven current and the density limit are studied. The scaling of I_{rf} is obtained as $n_e \times I_{rf}/P_{rf} \simeq 0.15 \times 10^{13}$ $kA.cm^{-3}.kW^{-1}$. The density limit exists and it depends on the energy distribution of electrons in the ohmically heated initial plasmas. The maximum value obtained in the present experiments is 1.4×10^{13} cm^{-3}. The high frequency instability associated with the RF driven current has been studied and found it can be stabilized by the electron cyclotron heating. (10 refs.)

Bremsstrahlung emission in a non LTE plasma .... See Entry 71704

The thermal self-focusing of a wave beam in an under dense plasma. I. The wave spectrum .... See Entry 71724

Parametric excitation of the drift wave by a modulated ion beam .... See Entry 71727

Current drive experiments on the PLT Tokamak .... See Entry 71729

Aspects of the physics of laser-plasma interactions .... See Entry 71744

Dynamics of heavy particles close to a negatively charged wall in a dense fully ionized plasma .... See Entry 71747

Plasma boundary layer in limiter and divertor Tokamaks .... See Entry 71749

Magnetoplasma lamination due to microwave gyroresonant heating .... See Entry 71754

Distortion of the distribution function of weakly RF heated minority ions in a Tokamak plasma .... See Entry 71755

Electrostatic corrections to the electron magnetic-drift waves .... See Entry 71765

Radiative amplification of reversed field diffusion in a neutral layer during the formation of a compact toroid .... See Entry 71771

Stellarators .... See Entry 71784

Characteristics of a transferred-arc plasma .... See Entry 71809

Stability of an astrophysical plasma near the onset of electron runaway .... See Entry 73989

52.25P Emission, absorption, and scattering of radiation

71702 The infrared emission spectrum of an argon plasma jet between 4 and 25 microns. G.Winkelmann, J.Tilgner (Zentralinst. fur Phys. Chem., Akad. der Wissenschaften, Berlin, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.193-9 (1983). In German.
The infrared emission spectrum of an argon plasma jet was investigated in the wavelength range from 4 to 25 microns by means of a Fourier-transform spectrometer. Besides numerous sharp emission lines of argon (FWHH=1 cm^{-1}) several broad intensity maxima are observed at 4.636 μm, 7.435 μm and 12.346 μm with a FWHH of 7; 20 and 39 cm^{-1}. (11 refs.)

71703 An efficient numerical method for time-dependent NLTE radiation transfer. D.J.Bond (Blackett Lab., Imperial Coll. of Sci., & Technol., London, England).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.429-34 (May 1983).
The author presents a numerical method for performing coupled time-dependent radiation transfer and atomic rate equation calculations. The method incorporates the desirable features of time-independent, non-local thermodynamic equilibrium (NLTE) radiation transfer calculations. It has the advantage that it allows existing time-independent calculations to be adapted to model time dependent effects. The approximations which are used are discussed. Calculations have been performed for a highly ionised silicon plasma with a single optically thick line. The line is taken to have a top-hat profile which is independent of position. Although the model is simple, it serves to illustrate some important features of time-dependent calculations. (9 refs.)

71704 Bremsstrahlung emission in a non LTE plasma. M.Lamoureux, C.Moller, P.Jaegle (Lab. de Spectroscopie Atomique et Ionique, Univ. Paris-Sud, Orsay, France).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.297-8 (9 May 1983).
The authors point out the great extent to which the calculated electron Bremsstrahlung emission departs from the LTE behaviour in the critical density region of a laser produced plasma. Consequences on the validity of a standard temperature diagnostic are discussed. (6 refs.)

71705 Plasma shifts of the Lyman lines to shorter wavelengths in C VI. J.C.Adcock,Jr., H.R.Griem (Lab. for Plasma, Univ. of Maryland, College Park, MD, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1369-72 (2 May 1983).
Blue shifts of ~85-60 mÅ have been observed for the first five members of the C VI Lyman series emitted from a laser-produced plasma plume at an electron density near 10^{21} cm^{-3}. These shifts are much larger than density-dependent effects associated with electron collisions and inhomogeneities in ion-produced electric microfields and opposite to plasma polarization shifts according to the linearized Debye model. A nonlinear Debye-type model is consistent with the measurements. (17 refs.)

71706 High-resolution X-ray spectra from molybdenum ions in the Alcator-*C* Tokamak. E.Kallne, J.Kallne (Harvard-Smithsonian Astrophys. Obs., Cambridge, MA, USA), R.D.Cowan.
Phys. Rev. A (USA), vol.27, no.5, p.2682-97 (May 1983).
The authors report on measurements of the X-ray line emission in the wavelength region $\lambda=4.3$-5.3 Å from molybdenum in charge states between 28+ and 32+. The experimental results were compared with calculated line spectra (also presented) which facilitated the identification of many of the principal $2p$-$3d$, $2s$-$3p$, and $2p$-$3s$ transitions. Some indications of weaker satellite-line contributions were also found. The principal $2p$-$3d$ transitions were found to be the dominant ones. In particular, Mo^{32+} gave stronger contributions than other charge states for our plasma condition of $T_e=1.0$-1.5 keV while available calculations of relative ion abundances have predicted Mo^{32+} to be relatively strongest at $T_e=2.5$-3.0 keV. (22 refs.)

71707 Multiply charged plasma-point ions. Yu.A.Bykovskii, G.A.Sheroziya.
Sov. Phys.-JETP (USA), vol.56, no.2, p.304-9 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.554-63 (Aug. 1982). [received: May 1983]
The singularities of the emission of multiply charged ions with charges up to $z=25$ from high-temperature 'plasma points' of a low-inductance spark are investigated. The existing theoretical premises concerning the nature of plasma points are analyzed. (23 refs.)

Aspects of the physics of laser-plasma interactions .... See Entry 71744

Detailed spectra of high-power broadband microwave emission from intense electron-beam-plasma interactions .... See Entry 71748

The interaction of carbon dioxide laser radiation with a pulsed vacuum arc .... See Entry 71761

Plasma formation in a gas-liner pinch .... See Entry 71773

Evidence of anomalous multiplet line shapes in optically thick, laser-produced plasmas .... See Entry 71796

52.30 PLASMA FLOW; MAGNETOHYDRODYNAMICS

(see also 47.65 Fluid dynamics)

71708 On the averaged forces in bounded plasma in parallel electric and magnetic fields. N.A.Nikolov, P.N.Malinov, A.B.Yanovsky (Dept. of Phys., Sofia Univ., Sofia, Bulgaria).
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.95-103 (1983).
Averaged forces of Miller's type, acting on the particles of a bounded plasma in parallel external AC electric and DC magnetic fields, are found on the basis of the equations of the two-component MHD. It is assumed, that standing transverse waves are excited in the plasma by the external source before the AC electric field is switched on. (16 refs.)

71709 The study of transverse magnetic field interaction with a two-phase low-temperature plasma flow. M.V.Zake, Ya.O.Shints, I.N.Yatchenko.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.75-83 (1983). In Russian.
The experimental investigation results of the transverse magnetic field interaction with low-temperature argon plasma containing aluminium particles are presented. Non-stationary heating, as well as evaporation and condensation of metal particles were studied. Gas dynamics and heat physics characteristics of plasma flow components were found to be greatly affected by the magnetic field magnitude. Thus, at $B<0.6$ T, the mean dimensions of a condensate increase whereas they have a pronounced decrease at $B>0.6$ T. (9 refs.)

71710 On the plasma-vacuum condition in the energy principle of Bernstein et al.. C.Lo Surdo (Centro Richerche Energia Frascati, Frascati, Roma, Italy).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.18, p.600-2 (30 April 1983).
Discusses the plasma-vacuum condition in the well-known energy principle for fluidomagnetic stability problems by Bernstein et al. (1958). (13 refs.)

71711 Resistive MHD processes. D.Biskamp (Max-Planck-Inst. fur Plasmaphys., Garching, Germany).
Phys. Scr. (Sweden), vol.T2, no.2, p.405-9 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The problem of fast magnetic reconnection across an x-type magnetic neutral point is reconsidered. Several different numerical computations of the 2D incompressible MHD equations are presented concerning externally driven as well as spontaneous reconnection. The common result of these computations is that in the limit of small resistivity reconnection occurs in a diffusion layer of finite length, corresponding to the Sweet-Parker reconnection model. A Petschek type process is only obtained by assuming a strongly enhanced resistivity in the diffusion region. (12 refs.)

Plasma—Particle momentum and heat transfer: modelling and measurements .. ..See Entry 71692

On the transition to turbulence in magneto-hydrodynamic models of confined plasmas ....See Entry 71734

Plasma boundary layer in limiter and divertor Tokamaks ....See Entry 71749

Radiative amplification of reversed field diffusion in a neutral layer during the formation of a compact toroid ....See Entry 71771

Observation of radial equilibrium and transition to a helix of a gas-embedded Z pinch ....See Entry 71774

The physics of spheromak ....See Entry 71778

Characteristics of a transferred-arc plasma ....See Entry 71809

Energy dynamics in stressed magnetic fields: the filamentation and flare instabilities ....See Entry 73983

52.35 WAVES, OSCILLATIONS, AND INSTABILITIES IN PLASMA

71712 Nonlinear theory of the instability of a modulated electron beam of low density in a plasma. I. Conservation laws of energy and momentum for electromagnetic waves in a nonequilibrium dispersive and dissipative medium in the case of a slow change of amplitude and phase of the wave. K.J.G.Kruscha (Sekt. Phys./Elektronik, Univ. Greifswald, Greifswald, Germany), A.N.Kondratenko.
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.105-15 (1983).
A formula is given for the energy and momentum conservation laws for a narrow spectrum of electromagnetic waves in an unstable dispersive and dissipative medium by any level of dissipation and on condition that the amplitude and phase change slowly in the time and space period of oscillations. It is shown that the density of energy and momentum of the motion of resonant particles, connected with the propagation of the electromagnetic wave, generally cannot be expressed by the dielectric function of the unstable system. For example it is demonstrated that the well known Landau formula for determining the density of the wave energy in an unstable monoenergetic beam-plasma system in general is not applicable as it is often done in literature. (32 refs.)

71713 The stability of the relativistic Alfven waves. C.D.Ciubotariu, D.I.Zoler, N.S.Thirer (Dept. of Phys., Polytech. Inst. of Jassy, Jassy, Rumania).
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.117-32 (1983).
Within the framework of the special relativity, the system of reference comoving with Alfven wave is defined and the form of the perturbations with respect to this system are deduced. The system of equations corresponding to the interaction of the waves, in the case when the relativistic Alfven wave can generate new Alfven waves and magnetosonic waves, is obtained in the most general form. In the one-dimensional case the time dependent perturbation method is used to obtain the dispersion equation for the relativistic coupled waves (decay processes). Finally, by solving numerically the dimensionless dispersion equation, the instability domains of the Alfven waves are obtained. It is shown that there are possible decay processes and modulational instabilities. (11 refs.)

71714 Polarizational instability of an extraordinary wave close to the electron cyclotron resonance. S.A.Bel'kov, V.N.Tsytovich.
Fiz. Plazmy (USSR), vol.9, no.2, p.240-9 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The nonlinear evolution of an extraordinary wave in a region near the electron cyclotron resonance is investigated. Equations are derived which describe the nonlinear variation of polarization, and solutions for monochromatic waves are studied. It is shown that the equations possess three different solutions, which correspond to three polarization waves, all of which are unstable. A quasistationary magnetic field is excited as a result of the development of the polarization instability. (15 refs.) *A.G.C.*

71715 The interaction of Rieman waves in a two-stream system and the nonlinear stage of a two-beam instability. A.V.Pashchenko.
Fiz. Plazmy (USSR), vol.9, no.2, p.264-72 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
A solution is found for a problem concerning the interaction of Rieman waves in a two-stream hydrodynamic system. The result is used to study the strongly nonlinear stage of a two-beam instability in a beam-plasma system when the densities of beam and plasma are comparable. The boundary of the instability at the hydrodynamic stage of the development, which occurs due to pumping of energy from one wave instability to another is described analytically. The amplitudes of all the variable quantities and the nonlinear growth rate vary with distance. The fine structure of the relationship of the amplitude to distance associated with the nonlinear action of a precursor to the propagating wave is investigated. (10 refs.) *A.G.C.*

71716 Electromagnetic solitons with trapped particles in an ion-beam plasma. I.V.Bachin, V.B.Krasovitskii.
Fiz. Plazmy (USSR), vol.9, no.2, p.278-81 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
It is shown that the propagation of solitons of electromagnetic (helical) fields along an ion beam in a plasma is accompanied by the capture of electrons with velocities close to the group velocity of the wave. The reverse effect of the trapped particles leads to the appearance of nonlinear dispersion of plasma and a reduction of the phase velocity of the wave in the region of propagation of field pulses. An optimum value for the density of the trapped electrons exists for which reduction of the phase velocity is synchronized with the braking of the ion beam and the field amplitude considerably exceeds the value for free solitons. This effect is considered as a possible mechanism for the acceleration of electrons along the magnetic field of the near-Earth plasma penetrated by means of solar protons. (3 refs.) *A.G.C.*

71717 Nonlinear stabilization of one-dimensional short wave modulation instability. B.N.Breizman, V.M.Malkin.
Fiz. Plazmy (USSR), vol.9, no.2, p.288-99 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The nonlinear stage of the modulation instability of wide spectra Langmuir turbulence is examined for conditions when the energy of the Langmuir waves is close to the instability threshold and the spatial scale of the growing disturbances are comaprable with the characteristic wavelength of plasmons. Equations are derived which describe the growth of the instability in a small nonlinearity approximation, and conditions for bringing about soft and hard nonlinear stabilization regimes are indicated. (10 refs.) *A.G.C.*

71718 Electrostatic modes in a magnetized plasma with a longitudinal density gradient. J.E.Maggs, G.J.Morales (Phys. Dept., Univ. of California, Los Angeles, CA, USA).
J. Plasma Phys. (GB), vol.29, pt.2, p.177-94 (April 1983).
An analytic study is made of the electrostatic mode structures which exist between the upper-hybrid cut-off and the plasma resonance in a plasma in which the zero-order density gradient points along the magnetic field. In general the solutions consist of long-wavelength cold modes which are converted to short-wavelength Bohm-Gross modes near plasma resonance. However, there exist certain discrete angles of propagation at which finite solutions exist that can be described solely in terms of cold plasma theory. The relevance of these processes to resonant absorption experiments in the auroral ionosphere is considered. A brief study is made of the changes produced by a finite angle between the density gradient and the magnetic field. The possibility of finding analogous low-frequency structures is also investigated. (5 refs.)

71719 On reflexion and trapping of upper-hybrid waves. E.Mjolhus (Inst. of Math. & Phys. Sci., Univ. of Tromso, Tromso, Norway).
J. Plasma Phys. (GB), vol.29, pt.2, p.195-215 (April 1983).
The theme of the paper is the relation between the so-called Z mode and the upper-hybrid wave in a magnetized plasma. First, certain problems as to reflexion and transmission of upper-hybrid waves at quasi cut-off (that is, cut-off predicted within electrostatic approximation) are stated and solved by singular perturbation technique. Then the theory is extended to a problem concerning generation and trapping of upper-hybrid waves in magnetic field aligned electron density irregularities. First a single density depression is considered, and then the formalism is further extended to a system of many parallel density depressions. The study was motivated by problems in the theory of artificial small-scale ionospheric irregularities occurring in radio wave experiments. (9 refs.)

71720 Magnetosonic wave propagation in the mode conversion regime. Y.Lapierre (EURATOM-CEA sur la Fusion, Fontenay-aux-Roses, France).
J. Plasma Phys. (GB), vol.29, pt.2, p.223-41 (April 1983).
The propagation of the fast magnetosonic wave is studied, taking into account the effect of the two-ion hybrid layer. Using a one-dimensional model, which includes density and magnetic field gradients, the wave equation is solved in the cold plasma approximation. The existence of radial eigenmodes confined between the two-ion hybrid layer and the low field side wall is predicted. Comparison with experimental data obtained on the TFR Tokamak confirms the theoretical conclusions. Toroidal eigenmodes are observed even in the mode conversion regime when the antenna is on the low magnetic field side. (22 refs.)

71721 The effect of microscale random Alfven waves on the propagation of large-scale Alfven waves. T.Namikawa, H.Hamabata (Dept. of Phys., Faculty of Sci., Osaka City Univ., Osaka, Japan).
J. Plasma Phys. (GB), vol.29, pt.2, p.243-53 (April 1983).
The ponderomotive force generated by random Alfven waves in a collisionless plasma is evaluated taking into account mean magnetic and velocity shear and is expressed as a series involving spatial derivatives of mean magnetic and velocity fields whose coefficients are associated with the helicity spectrum function of random velocity field. The effect of microscale random Alfven waves through ponderomotive and mean electromotive forces generated by them on the propagation of large-scale Alfven waves is also investigated. (11 refs.)

71722 Nonlinear interaction of waves in sharply bounded plasmas. T.Lindgren (Dept. of Plasma Phys., Umea Univ., Umea, Sweden).
J. Plasma Phys. (GB), vol.29, pt.2, p.255-73 (April 1983).
The author considers the nonlinear interaction of three high-frequency waves and low-frequency density perturbations in a sharply bounded plasma. The coupled equations are presented in a general and convenient form. To demonstrate the usefulness of the author's method explicit expressions are derived for the threshold of a number of possible instabilities in semi-finite and cylindrical plasmas. (29 refs.)

71723 Notes on the stability problem for inhomogeneous equilibria. K.R.Symon (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Plasma Phys. (GB), vol.29, pt.2, p.275-86 (April 1983).
Several conclusions regarding the stability of inhomogeneous Vlasov equilibria are drawn from earlier work. A technique is presented for generating first-

order formulae for the change $\delta\omega$ in the frequency of any normal mode, when a parameter λ characterizing the equilibrium is changed slightly. Several applications are given, including a first-order calculation of the growth rate or damping of an electromagnetic mode due to the presence of plasma. A condition is derived for the existence of a normal mode with real frequency. When there are ignorable co-ordinates, the normal modes can be written in the form of waves propagating in the ignorable directions. The character of the modes depends on certain symmetries in the dynamic spectral matrix. Special cases arise when the orbits can be approximated in certain ways. (5 refs.)

71724 The thermal self-focusing of a wave beam in an under dense plasma. I. The wave spectrum. M.J.Giles (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
J. Plasma Phys. (GB), vol.29, pt.2, p.325-58 (April 1983).
The present series of papers is concerned with the problem of the thermal self-focusing of an electromagnetic wave in an underdense plasma which is examined within the context of ionospheric modification by high-power radio waves. The author formulates this problem as a coherent four-wave interaction between a pump wave, Stokes side-band waves and a thermally driven density perturbation. The treatment assumes that the heating of the electrons in the interference pattern of the pump and side-band waves is in equilibrium with longitudinal heat conduction and energy transfer to the ions and, in addition, that the density perturbation is subject to decay on account of longitudinal ambipolar diffusion, ambient plasma drift motion, recombination and the stabilizing influence of perturbations to the electrical conductivity. The author deals with the linear theory of the instability with a view to determining the effect of a finite beam width. The author attacks this problem by considering the response of the plasma-beam system to a small localized source, obtaining a response function which is evaluated asymptotically for large times. The author concentrates on the finite beam width in the direction perpendicular to the axis in the plane of the axis and the magnetic field. The author therefore includes the component of the drift parallel to this plane but ignores the component perpendicular to it, which is considered later. (15 refs.)

71725 Experimental determination of the velocity and width of plane ion-acoustic solitons propagating in a plasma. T.Pierre, G.Bonhomme, J.R.Cussenot, G.Leclert (Lab. de Phys. des Milieux Ionises, Faculte des Sci., Vandoeuvre les Nancy, France).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.159-61 (25 April 1983).
The velocity and width of plane ion-acoustic solitons propagating in a plasma have been studied experimentally. The measurement of their amplitude is made by analysis of the 'instantaneous' probe characteristics in the soliton. The results agree with the KdV theory, in contrast with previous works. (13 refs.)

71726 Coherence and threshold of current-driven potential relaxation instability. R.Schrittwieser (Phys. Dept., Univ. of California, Irvine, CA, USA).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.162-4 (25 April 1983).
It is shown that the coherence of the current-driven potential relaxation instability decreases with the plasma density whereas the threshold increases. (14 refs.)

71727 Parametric excitation of the drift wave by a modulated ion beam. M.Yatsuzuka, K.Satoh, S.Nobuhara (Dept. of Electrical Engng., Himeji Inst. of Technol., Himeji, Japan), K.Yatsui, M.Yokoyama.
Phys. Lett. A (Netherlands), vol.95A, no.6, p.293-6 (9 May 1983).
Parametric excitation of the drift wave is observed by an ion beam modulated near the lower-hybrid frequency. An RF field parallel to the magnetic field is found to play an important role in the excitation of the instability. Substantial increase of the ion and electron temperatures is observed. (10 refs.)

71728 Runaway-current sustainment by lower-hybrid waves. L.Muschietti, K.Appert, J.Vaclavik (Centre de Recherches en Phys. des Plasmas Assoc. EURATOM, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1532 (9 May 1983).
Recently Liu et al. (vol.48, p.1479, 1982) has proposed a theory to explain the low-density current-derived experiments, in which they have assumed a steady state too prematurely. In contrast to the runaway case (see Muschietti et al., vol.25, p.1187, 1982) there is indeed no DC electric field to accelerate the electrons in the region $[v_c, v_D]$. Because of that Liu et al. had to assume that the distribution function displays a negative slope there; thus they may balance the backward flux due to collisions with the quasilinear diffusion by the plasma waves. However, this assumption is inconsistent with the pitch-angle diffusion by the anomalous Doppler effect which happens in the adjacent region $v>v_D$ and must manifest itself in the region $[v_c,v_D]$ by the advent of a positive slope. Since the equations used in the model are the same as in the authors' quasilinear code they have tested the model numerically. They found that, for a realistic range of parameters, the preformed runaway tail cannot be maintained and the current carriers relax toward the bulk of the electron distribution. Thus, the authors claim that the Liu et al.'s model is inconsistent with their equations. (2 refs.)

71729 Current drive experiments on the PLT Tokamak. F.Jobes, S.Bernabei, P.Efthimion, W.Hooke, J.Hosea, E.Mazzucato, E.Meservey, R.Motley, J.Stevens, S.von Goeler (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.418-22 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
Lower hybrid current-drive experiments have been carried out on the PLT Tokamak. Steady currents up to 175 kA have been maintained for three seconds and 400 kA for 0.3 s by the RF power alone. The principal current carrier appears to be a high energy (~100 keV) electron tail, concentrated in the central 20-40 cm diameter core of the 80 cm PLT discharge. Effective current drive is observed only for $\bar{n}_e \leq 8\times10^{12}$ cm^{-3}. This limitation may be a wave propagation phenomenon and not a fundamental plasma physics effect. (5 refs.)

71730 Early history. E.Teller (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
In book: *Fusion. Vol.1. Magnetic confinement. Part A*, E.Teller [Ed.], p.1-29. London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
The author gives the historical background to fusion. He explains the reasons for the basic similarity as well as the great difference between the rapid development of thermonuclear explosions and the difficult research on thermonuclear reactors. He discusses controlled fusion in low-density plasmas and types of magnetic fusion machines as well as plasma properties and the role of instabilities. (4 refs.)

71731 Tokamak plasma stability. M.N.Rosenbluth, P.H.Rutherford.
In book: *Fusion. Vol.1. Magnetic confinement. Part A*, E.Teller [Ed.], p.31-121. London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
The authors point out the central role which the control of instabilities play in the problem of magnetically controlled fusion. Their discussion on stability consists of a general look at thermodynamic considerations pertinent to the stability of magnetically confined plasmas, and a categorisation of the principal types of instability in both open and closed confinment systems. The authors have emphasised the Tokamak because its axial symmetry renders it most amenable to theoretical treatment and because it is now the leading reactor contender.

Electrical conductivity for radio-frequency fields in strongly magnetized plasmas with density fluctuations .... See Entry 71696

Magnetic field line reconnection experiments .... See Entry 71699

Experiments with pure electron plasmas .... See Entry 71700

Lower hybrid current derive and sustainment in WT-2 Tokamak .... See Entry 71701

On the plasma-vacuum condition in the energy principle of Bernstein et al. .... See Entry 71710

Anomalously high absorption and anomalously strong scattering in a turbulent laser plasma .... See Entry 71732

The ponderomotive force and magnetic field generation effects resulting from the non-linear interaction between plasma-wave and particles ..See Entry 71736

Parametric instability of waves with an inhomogeneous pumping wave field in an inhomogeneous plasma .... See Entry 71738

Collisionless electron acceleration in the interaction of a microwave field with a dense isotropic nonuniform plasma .... See Entry 71739

Damping of large-amplitude plasma waves propagating perpendicular to the magnetic field .... See Entry 71743

Evolution of a nonlinear stage of a beam instability of plasma in a magnetic field .... See Entry 71750

Nonlinear stabilization of a collisionless radial divergence of a relativistic electron beam in a plasma .... See Entry 71751

Physics of REB-plasma interaction .... See Entry 71753

Distortion of the distribution function of weakly RF heated minority ions in a Tokamak plasma .... See Entry 71755

Electron cyclotron heating of a Tokamak plasma .... See Entry 71756

Electrostatic corrections to the electron magnetic-drift waves .... See Entry 71765

Determination of the runaway-electron distribution function by cyclotron absorption in a Tokamak .... See Entry 71766

Internal helical instabilities in a Tokamak with anisotropic plasma .... See Entry 71767

Ideal MHD ballooning modes in toroidal magnetic traps with shear .... See Entry 71770

Transverse ion losses in end stoppers of an ambipolar trap ..... See Entry 71772

Observation of radial equilibrium and transition to a helix of a gas-embedded *Z* pinch .... See Entry 71774

The physics of spheromak .... See Entry 71778

Stability and confinement of spheromaks and field reversed configurations .... See Entry 71780

The Tokamak .... See Entry 71783

Stellarators .... See Entry 71784

The reversed-field pinch .... See Entry 71787

Longitudinal oscillations in a relativistic plasma .... See Entry 71788

Density fluctuation measurement by infrared light scattering ..See Entry 71800

Ion-acoustic instabilities of DC discharges in rare gases at low pressures. II. Experimental results in comparison with a one-dimensional kinetic dispersion theory .... See Entry 71815

Mechanism for the development of the ionization instability in a nonself-sustained gas discharge plasma .... See Entry 71820

Linear transformation of a slow extraordinary wave into a fast wave close to the upper hybrid resonance. Earth's radio emission in the kilometric range .... See Entry 73958

Energy dynamics in stressed magnetic fields: the filamentation and flare instabilities .... See Entry 73983

Stability of an astrophysical plasma near the onset of electron runaway .... See Entry 73989

52.35R Plasma turbulence

71732 Anomalously high absorption and anomalously strong scattering in a turbulent laser plasma. V.Yu.Bychenkov, V.P.Silin.
Fiz. Plazmy (USSR), vol.9, no.2, p.282-7 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
Basic theories of ion-acoustic absorption and scattering of laser radiation are formulated with the help of angular scattering found for ion-acoustic fluctuations and of generalized Kadomtsev-Petviashvili spectra. It is shown that the interaction of electromagnetic radiation with an ion beam can lead to anomalously large absorption and scattering of radiation. (9 refs.) *A.G.C.*

71733 Computer simulation of plasma turbulence in open systems. Yu.S.Sigov (Keldysh Inst. of Appl. Maths., Acad. of Sci., Moscow, USSR).
Phys. Scr. (Sweden), vol.T2, no.2, p.367-79 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
A short review of the results of kinetic simulation of collective phenomena in open plasma systems with the variable total energy and number of particles, i.e. the particle and energy fluxes on boundary surfaces and/or their internal sources and channels is given. Three specific problems are considered in different detail for such systems in one-dimensional geometry: the generation and evolution of double layers in a currently unstable plasma; the collisionless relaxation of strongly non-equilibrium electron distributions; the Langmuir collapse and strong electrostatic turbulence in systems with parametric excitation of a plasma by an external pumping wave and with cooling the fast non-Maxwell electrons. In all these cases the non-linearity and a collective character of processes give examples of new dissipative plasma structures that essentially widen ideas about the nature of the plasma turbulence in non-homogeneous open systems. (40 refs.)

71734 On the transition to turbulence in magneto-hydrodynamic models of confined plasmas. E.K.Maschke, B.Saramito (Dept. de Recherches sur la Fusion Controlee, CEN, Fontenay-aux-Roses, France).
Phys. Scr. (Sweden), vol.T2, no.2, p.410-17 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
Starting from a model of an interchange-unstable plasma in a shearless magnetic field, the successive bifurcations and the transition to turbulence of the system are studied in various approximations. Numerical calculations using the finite element method and a spectral method with mode truncation yield converging results in certain domains of parameters. In the last part of the paper it is shown that a tearing-unstable plasma in a sheared magnetic field has a formally similar description and therefore should also be investigated in terms of bifurcation theory. (18 refs.)

Electrical conductivity for radio-frequency fields in strongly magnetized plasmas with density fluctuations .... See Entry 71696

Magnetic field line reconnection experiments .... See Entry 71699

Nonlinear stabilization of one-dimensional short wave modulation instability .... See Entry 71717

Detailed spectra of high-power broadband microwave emission from intense electron-beam-plasma interactions .... See Entry 71748

Plasma heating by rotating relativistic electron beams .... See Entry 71752

Investigations of the turbulent flow field in a high-speed plasma jet enclosed in a vessel .... See Entry 71801

52.35T Shock waves

71735 Laser generation of strong shock waves. S.I.Anisimov, A.M.Prokhorov, V.E.Fortov (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.63-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1081-9 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
After a brief survey of models for the equation of state, the authors give some simple estimates of the pressures in shock waves generated by laser pulses and discuss the roles of various factors that distort the ideal setting of the shock-wave experiments. These factors include rear and lateral decompression waves, which cause a deviation from the steady state in the shock wave, non-Maxwellian electrons and X-rays, which heat the target before the arrival of the shock wave, and transport and relaxation processes, which determine the generation time for the steady state shock wave. The authors derive the optimum working conditions and estimate the laser energy needed to obtain a given pressure. The final part of the survey deals with diagnosis in laser shock-wave experiments. (36 refs.)

The interaction of carbon dioxide laser radiation with a pulsed vacuum arc .... See Entry 71761

52.40 PLASMA INTERACTIONS

52.40D Electromagnetic wave propagation in plasma

71736 The ponderomotive force and magnetic field generation effects resulting from the non-linear interaction between plasma-wave and particles. He Xian-tu (Inst. of Atomic Energy, Acad. Sinica, Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.325-37 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Starting from Vlasov-Maxwell equations by using the method of self-consistent field theory, the author sets up first the coupling relation between distribution function and density of low-frequency oscillating particles and high-frequency EF, low-frequency MF in Fourier representation. Then, in the time-space representation, a set of equations for the nonlinear interaction including the effects of magnetic field generation, ponderomotive force and Landau damping are derived through the expansion of the low-frequency linear dielectric function under various approximations. Finally, also the author gives the Lagrangian density and conserved quantities and discusses briefly whether the magnetic field can promote the formation of soliton in three dimensions. (11 refs.)

71737 Diffraction of electromagnetic waves on a metal ball surrounded by a spherically symmetric uniform plasma layer taking into account the spacial dispersion. N.A.Azarenkov, V.P.Olefir, I.Kh.Peneva.
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.98-107 (1983).
The penetration of a plane electromagnetic wave in a spherically symmetric uniform plasma layer surrounding a metal ball has been considered. The amplitudes of the secondary fields in the high-and low-frequency ranges have been calculated. The spectra of own multipole resonance vibrations, defined by the thermal electron motion, have been obtained. (10 refs.)

71738 Parametric instability of waves with an inhomogeneous pumping wave field in an inhomogeneous plasma. A.A.Andreev.
Fiz. Plazmy (USSR), vol.9, no.2, p.231-3 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The problem of the interaction of waves in a plasma when pumping wave and plasma are inhomogeneous with respect to various coordinates as occurs for example when a laser beam propagates in an inhomogeneous plasma, is examined. From a system of full equations shortened versions are derived which are examined in a resonance decay region. The amplification coefficient obtained is similar to that obtained by other authors. (6 refs.) *A.G.C.*

71739 Collisionless electron acceleration in the interaction of a microwave field with a dense isotropic nonuniform plasma. I.R.Gekker.
Fiz. Plazmy (USSR), vol.9, no.2, p.234-9 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
An analysis is presented of experimental data from the interaction of microwaves with a dense strongly nonuniform isotropic plasma in a waveguide, with a range of variation of E of from 1 to 10^4 v/cm. It is shown that calculated threshold values of the fields for parametric instability in a nonuniform plasma considerably exceed the thresholds recorded for accelerated electrons, which prevents the detection of electron instability thresholds. Comparison of experimental data indicates agreement with theoretical ideas concerning the resonance mechanism of electron acceleration. (19 refs.) *A.G.C.*

71740 The 'super-reflection' effect during the interaction of high power radiation with moving plasma. N.E.Andreev, K.Baumhertel, O.M.Gradov, K.Zauer, D.Zunder.
Fiz. Plazmy (USSR), vol.9, no.2, p.254-63 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The conditions for producing a 'super-reflection' effect, both analytically within the framework of a simple model of the evolution of the plasma density profile, and using self-consistent numerical methods for the deformation of plasma density by the ponderomotive force, are investigated. (10 refs.) *A.G.C.*

71741 Whistler-mode propagation at frequencies near the electron gyrofrequency. S.S.Sazhin (Phys. Inst., State Univ. Leningrad, Leningrad, USSR).
J. Plasma Phys. (GB), vol.29, pt.2, p.217-22 (April 1983).
Parallel whistler-mode propagation in a hot anisotropic plasma at frequencies near the electron gyrofrequency is considered by using analytical methods and a simple graphical technique, without any special restrictions on the value of the imaginary part of the plasma dispersion function argument. An exact criterion for the possibility of whistler-mode propagation in the vicinity of the electron gyrofrequency is derived. In particular it is pointed out that whistlers in this frequency interval can propagate only in a very hot and rarefied plasma submerged in a strong magnetic field. These whistlers can only be damped, the modulus of the decrement of the damping cannot exceed 1.1 times the electron plasma frequency. The refractive index remains close to unity. (10 refs.)

71742 Magnetic-field generation by a finite-radius electromagnetic beam. O.M.Gradov (P.N. Lebedev Phys. Inst., Moscow, USSR), L.Stenflo.
Phys. Lett. A (Netherlands), vol.95A, no.5, p.233-4 (2 May 1983).
The authors point out that magnetic fields can be generated in a plasma because of the inhomogeneity in the radial intensity distribution of a linearly polarized electromagnetic beam. (4 refs.)

71743 Damping of large-amplitude plasma waves propagating perpendicular to the magnetic field. J.M.Dawson, V.K.Decyk, R.W.Huff, I.Jechart, T.Katsouleas, J.N.Leboeuf, B.Lembege, R.M.Martinez, Y.Ohsawa, S.T.Ratliff (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1455-8 (9 May 1983).
Computer simulations of magnetosonic waves, velocity-shell instabilities, and upper hybrid heating show evidence of a general damping mechanism for large-amplitude electrostatic waves propagating perpendicular to a magnetic field: Particles trapped by a wave of frequency ω and phase velocity V_{ph} see an electric field $V_{ph}\times B$, which accelerates them parallel to the wave front until the $\nu\times B$ force is large enough for detrapping. For $\omega\gg\omega_c$, velocities as large as $(\omega/4\omega_c)V_{ph}$ can be attained, within a time $\omega_c t\approx\omega/4\omega_c$. (8 refs.)

71744 Aspects of the physics of laser-plasma interactions. T.J.M.Boyd (Univ. of Wales, Bangor, Wales).
Phys. Scr. (Sweden), vol.T2, no.2, p.310-23 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
A variety of topics in laser-plasma interaction physics are reviewed. The trend from exploding-pusher experiments to ablative compression studies already evident at the time of the Nagoya Conference in 1980 has gathered momentum. The particular emphasis placed at present on the scaling of interaction phenomena with wavelength, in particular stimulated Raman scattering and two-plasmon decay, filamentation and jet formation together with aspects of absorption and transport phenomena is essential for a proper understanding of laser-plasma interactions. (83 refs.)

71745 Intense laser self-focusing in plasmas. Xu Zhizhan, P.H.Y.Lee, Xu Yuguang, Zhang Wenqi, Wang Lijun (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Sci. Sin. (China), vol.26, no.4, p.435-41 (April 1983).
Strong evidence for self-focusing or filamentation of a laser beam in plasmas is found from time-integrated 1-D spatially resolved spectra and 2-D spatially resolved images of the second harmonic emission from 1.06 μm laser-plasma interactions. The authors also present preliminary results of investigation of factors such as target *Z* and prepulse which affect self-focusing or filamentation. (14 refs.)

Stochastic current driven by a wave .... See Entry 71693

Electrical conductivity for radio-frequency fields in strongly magnetized plasmas with density fluctuations .... See Entry 71696

Electromagnetic solitons with trapped particles in an ion-beam plasma .... See Entry 71716

Anomalously high absorption and anomalously strong scattering in a turbulent laser plasma .... See Entry 71732

Magnetoplasma lamination due to microwave gyroresonant heating .... See Entry 71754

52.40F Antennas in plasma; plasma-filled wave guides

71746 Radiation resistance of corner-driven loop antenna immersed in a two component warm plasma. A.Kumar, R.K.Gupta (Dept. of Phys., Malaviya Regional Engng. Coll., Jaipur, India).
Curr. Sci. (India), vol.52, no.5, p.214-125 (5 March 1983).
Loop aerials of different types are widely used for satellite communications and rocket-probe studies in the ionosphere. They are simple in construction, and more efficient than conventional dipoles of similar dimensions. The radiation characteristics of corner-driven loop antenna have not yet been studied in two component warm plasma. The purpose of the note is to compare the theoretical values of the radiation resistance of the corner-driven loop with the experimental observations of the loop used on Ariel-3 satellite and the theoretical results from an Alford loop aerial in an electron-ion warm plasma. (3 refs.)

Magnetosonic wave propagation in the mode conversion regime .... See Entry 71720

Collisionless electron acceleration in the interaction of a microwave field with a dense isotropic nonuniform plasma .... See Entry 71739

52.40H Solid-plasma interactions

71747 Dynamics of heavy particles close to a negatively charged wall in a dense fully ionized plasma. A.V.Zharinov, Yu.V.Sanochkin.
Fiz. Plazmy (USSR), vol.9, no.2, p.397-400 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The distribution of densities and balance of heavy particles in a bounded layer formed during the contact of dense cold fully-ionized plasma with a negatively charged wall are examined. The breakdown time of the pre-electrode layer in the presence of cathode sputtering and vaporization of the surface of the walls is estimated. (5 refs.) *A.G.C.*

71748 Detailed spectra of high-power broadband microwave emission from intense electron-beam-plasma interactions. K.G.Kato, G.Benford, D.Tzach (Dept. of Phys., Univ. of California, Irvine, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1587-90 (16 May 1983).
For a relativistic electron beam penetrating an unmagnetised plasma, a change is seen in the emission spectrum from $\omega\sim\omega_p, 2\omega_p$ line emission to

continuous $\omega \gg \omega_p$ emission, as $n_b/n_p \rightarrow 1$. High-power (of order megawatts per gigahertz) broadband radiation up to ~100 GHz suggests collective Compton-boosting mechanisms in a new regime of super-strong turbulence. Highly directional emission and magnetic field dependence agree with this interpretation. (16 refs.)

71749 Plasma boundary layer in limiter and divertor Tokamaks. M.Keilhacker, K.Lackner, K.Behringer, H.Murmann, H.Niedermeyer (Max-Planck-Inst. fur Plasmaphys., Garching, Germany).
Phys. Scr. (Sweden), vol.T2, no.2, p.443-53 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
Experimental results and theoretical models for the boundary layer of toroidal confinement devices are described. Emphasis is put on the scrape-off layer of poloidal divertor Tokamaks which have demonstrated a significant reduction in impurity content as compared to limiter operation. The competition of transport processes parallel and perpendicular to the field lines, determining the profiles of plasma density, temperatures and impurity concentrations, is described. The role of hydrogen recycling in the divertor chamber is underlined, which decides the flow Mach number in the scrape off, the plasma parameters in the target plate vicinity and the regime of energy transport along the field lines. Limiter and divertor operation in ASDEX are compared and the favourable results of the latter explained by the reduced impurity production of target plates and their distance from closed field lines, which impurity ions would have to overcome by diffusion against the plasma flow into the divertor chamber. (29 refs.)

Plasma boundary diagnostics by laser induced fluorescence .....See Entry 71799

Collision of a low-temperature laser plasma with a condensed medium .....See Entry 72256

^{252}Cf plasma desorption in ion implanted mica .....See Entry 73389

52.40K Sheaths

Computer simulation of plasma turbulence in open systems .... See Entry 71733

Radiative amplification of reversed field diffusion in a neutral layer during the formation of a compact toroid .....See Entry 71771

52.40M Beam interactions in plasma

71750 Evolution of a nonlinear stage of a beam instability of plasma in a magnetic field. G.D.Aburdzhaniya, I.M.Pankratov.
Fiz. Plazmy (USSR), vol.9, no.2, p.273-7 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The excitation of longitudinal oscillations of a plasma by a nonrelativistic spiral monoenergetic low density beam is investigated numerically in a single-mode approximation for the case when the wave propagates at an angle of about $\pi/2$ to the magnetic field. It is shown that during the growth of the instability a qualitative change in the form of the phase density of the particles of the beam is possible. (5 refs.) *A.G.C.*

71751 Nonlinear stabilization of a collisionless radial divergence of a relativistic electron beam in a plasma. V.G.Dorofeenko, V.B.Krasovitskii.
Fiz. Plazmy (USSR), vol.9, no.2, p.357-65 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
A study is reported of the defocusing effect of Cerenkov and cyclotron modes on a relativistic beam of electrons moving in a plasma long an external magnetic field. The role of nonlinear effects in conditions of collective scattering of resonance electrons on plasma oscillations is explained and possible mechanisms of nonlinear stabilization of the instability are indicated. Nonlinear saturation of the Cerenkov mode takes place even in weak magnetic fields due to the reduction in growth rate with increase in amplitude of oscillations in the beam. The cyclotron (anomalous Doppler) mode is stabilized by the effect of nonlinear dispersion in a plasma accompanied by detuning of the phase resonance of the beam with the wave. In both cases the oscillation amplitudes of the radius of the beam and the field are found. (5 refs.) *A.G.C.*

71752 Plasma heating by rotating relativistic electron beams. P.I.John (Phys. Res. Lab., Ahmedabad, India).
Phys. Scr. (Sweden), vol.T2, no.2, p.298-302 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
Experimental observations on the interaction of intense electron beams with magnetically confined plasmas, when the beam has a substantial component of the velocity in the direction perpendicular to the magnetic field are summarised. The interaction takes place in two stages; in the first stage the response is essentially magnetic due to return currents induced in the plasma, and in the second stage, those currents decay converting energy into plasma heating. Observation of fast magnetic field diffusion points to beam-induced turbulence in the plasma. (10 refs.)

71753 Physics of REB-plasma interaction. A.V.Arzhannikov, A.V.Burdakov, V.S.Koidan, L.N.Vyacheslavov (Inst. of Nuclear Phys., Novosibirsk, USSR).
Phys. Scr. (Sweden), vol.T2, no.2, p.303-9 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The results of the experimental study of the REB-plasma interaction in the two-stream instability regime are presented. The distribution function of plasma electrons has been studied with the use of the laser scattering system, soft X-ray diagnostics and a multifoil analyzer of fast electrons. It is shown that during an effective REB-plasma interaction the distribution function of heated electrons is strongly non-equilibrium. A high-energy part of the distribution function has been registered in the experiments simultaneously by three independent methods. The density of 'hot' electrons with a characteristic energy of about 1 keV constitutes several per cent of the total plasma density. The experimental results obtained are discussed in terms of the two-stream instability of the REB in a plasma. (42 refs.)

Nonlinear theory of the instability of a modulated electron beam of low density in a plasma. I. Conservation laws of energy and momentum for electromagnetic waves in a nonequilibrium dispersive and dissipative medium in the case of a slow change of amplitude and phase of the wave ..... See Entry 71712

The interaction of Rieman waves in a two-stream system and the nonlinear stage of a two-beam instability .....See Entry 71715

Electromagnetic solitons with trapped particles in an ion-beam plasma .....See Entry 71716

The thermal self-focusing of a wave beam in an under dense plasma. I. The wave spectrum .....See Entry 71724

Parametric excitation of the drift wave by a modulated ion beam .....See Entry 71727

Internal helical instabilities in a Tokamak with anisotropic plasma .....See Entry 71767

REB injected toroidal plasma .....See Entry 71781

52.50 PLASMA PRODUCTION AND HEATING

71754 Magnetoplasma lamination due to microwave gyroresonant heating. A.B.Shvartsburg (Izmiran, Troitsk, USSR).
Beitr. Plasma Phys. (Germany), vol.23, no.1, p.1-8 (1983).
The hysteresis transitions between two temperature states of a collisional magnetoplasma due to Joule heating near by the electron gyroresonance are analysed. The propagation of intense extra-ordinary gyroresonant microwave across the magnetic field in a plasma is responsible for such jump-like thermic effects, the wave amplitudes being less than the 'characteristic plasma field'. The transversal heat conductivity may lead to formation of spatially periodical temperature profiles in the hysteresis region of wave's intensity; the spatial periods of such profiles are much less than the Joule dissipation length of heating wave. The thermodiffusion, stimulated by temperature lamination, may form the spatial oscillations of magneto-plasma density across the magnetic field. (6 refs.)

71755 Distortion of the distribution function of weakly RF heated minority ions in a Tokamak plasma. D.Anderson (Inst. for Electromagnetic Field Theory, Chalmers Univ. of Technol., Goteborg, Sweden).
J. Plasma Phys. (GB), vol.29, pt.2, p.317-23 (April 1983).
An investigation is made of the effect of RF-induced velocity diffusion on the distribution function, $f(\mathbf{v})$, of the heated ion species in minority heating schemes using the fast Alfven wave. The solution for the distorted distribution function is expressed in a Legendre series from which deviations from isotropy can be assessed. Solutions are found in the limits of high and low velocities and the elongation of the constant $f(\mathbf{v})$ surfaces is also given. (2 refs.)

71756 Electron cyclotron heating of a Tokamak plasma. V.E.Golant (A.F. Ioffe Phys.-Tech. Inst., Leningrad, USSR).
Phys. Scr. (Sweden), vol.T2, no.2, p.428-34 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
Contains the analysis of the state of electron cyclotron resonance heating in Tokamaks. It presents the results of numerical simulation of ECRH at different conditions and the review of last experiments performed on Tokamaks T-10, FT-1, JFT-2 and JSX-B. The opportunities and constraints of ECRH in Tokamaks are discussed. (25 refs.)

Parametric excitation of the drift wave by a modulated ion beam .....See Entry 71727

Runaway-current sustainment by lower-hybrid waves .....See Entry 71728

Damping of large-amplitude plasma waves propagating perpendicular to the magnetic field .....See Entry 71743

Plasma heating by rotating relativistic electron beams .....See Entry 71752

Internal helical instabilities in a Tokamak with anisotropic plasma .....See Entry 71767

Plasma heating experiments at the second harmonic of the electron cyclotron resonance in the T-10 Tokamak .....See Entry 71768

Plasma formation in a gas-liner pinch .....See Entry 71773

Observation of radial equilibrium and transition to a helix of a gas-embedded *Z* pinch .....See Entry 71774

The Tokamak .....See Entry 71783

The reversed-field pinch .....See Entry 71787

52.50J Plasma production and heating by laser beams

71757 Breakdown in air near a solid target in a CO_2 laser beam. V.I.Konov (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.31-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1044-51 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
To determine which type of plasma is observed in an experiment and the corresponding mechanism for interaction between the radiation and the target, it is necessary particularly to define the fundamental differences between the two types of laser plasma. Naturally, if the target is irradiated in a sufficiently high vacuum, breakdown in the adjacent layers of residual gas is impossible, and therefore the observed plasma is also always a vapor jet. A much more complicated situation arises when the target is irradiated in a gas, including air, at pressures not too widely different from normal, where one can get either a vapor jet or a gas breakdown plasma in accordance with the conditions. It is therefore very important to devise criteria that define the type of plasma reliably; although low-threshold gas breakdown near the target was observed comparatively long ago, the literature often speaks only of plasma formation generally or else that air breakdown is observed near the target without indicating a sufficient basis for this. The author used a pulsed TEA CO_2 laser in the spectroscopic studies. (18 refs.)

71758 Pulse heating of a metal by a laser plasma in a subsonic air flow. V.P.Ageev, A.A.Gorbunov, V.I.Konov, P.I.Nikitin, A.S.Silenok, N.I.Chapliev (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.43-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1058-64 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
When the irradiation spot is small, most of the energy absorbed by the target in laser breakdown enters parts of the surface fairly remote from the energy release medium. This is explainable in terms of concepts from explosions. A region of hot gas or hot sphere (HS) is formed when the explosion products and the air entrained by the shock wave expand to atmospheric pressure P_0. The HS localizes much of the energy, but the size may substantially exceed that of the deposition zone. The authors consider the time and mechanism of the energy transfer from the HS formed by low-threshold gas breakdown near a solid surface. (9 refs.)

71759 Slow burning of a laser plasma. I.A.Bufetov, A.M.Prokhorov, V.B.Fedorov, V.K.Fomin.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.114-21 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1141-9 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
A brief survey is made of papers on the slow burning of a laser plasma. Detailed consideration is given to experiments on discharge propagation in the slow-burning mode along the beam of a neodymium laser in atmospheric air. Gas motion has been observed in front of and behind the discharge front. The threshold conditions have been examined for plasma propagation in the laser beam and absorption of the laser radiation in the discharge. (41 refs.)

71760 Spectral study of a carbon laser plasma expanding into a background medium. O.B.Anan'in, Yu.A.Bykovskii, B.V.Zamyshlyaev, A.G.Guz', E.L.Stupitskii, A.M.Khudoverdyan.
Fiz. Plazmy (USSR), vol.9, no.2, p.319-25 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The results of an investigation into the space-time characteristics of the separate charges of the ion component of a carbon laser plasma (CII,CIII) during its expansion into a rarefied background medium (air) in a pressure range of from 10^{-3} to 10^{-1} torr are reported. The diagnostic method used was time-of-flight spectrometry of the line radiation from the laser plasma formed on a carbon target. The relationship of the space and time distribution of ions with respect to distance from the target and the background pressure is shown. Results are presented of a theoretical analysis of the mechanism of the interaction of a laser plasma with the background medium, which leads to a process of energy transfer to the background medium. Results of the calculations are compatible with experiments. (6 refs.) *A.G.C.*

71761 The interaction of carbon dioxide laser radiation with a pulsed vacuum arc. T.P.Hughes, M.A.El-Farra (Dept. of Phys., Univ. of Essex, Colchester, England).
J. Phys. D (GB), vol.16, no.5, p.811-28 (14 May 1983).
A pulsed, channelled vacuum arc is described which produces reproducible carbon plasmas with $N_e \sim 1.5 \times 10^{18}$ cm^{-3} and $T_e \sim 4.5$ eV. Spectroscopic measurements in the VUV and visible regions have been used to determine accurately the distributions of N_e and T_e in time and space. The absorption of CO_2 laser pulses at irradiances up to 2×10^9 W cm^{-2} by the plasma has been measured and for small absorbed energies is in good agreement with the predictions of inverse bremsstrahlung theory. The electron temperature in the plasma rose by over 5 eV when strong absorption occurred, resulting in a smaller absorption for the later part of the laser pulse and a delay in the peak of the transmitted pulse. A weak cylindrical blast wave was generated whose propagation was followed spectroscopically. (21 refs.)

71762 Observation of Stark-shifts of Lyman-α lines of low-Z ions in laser-produced plasmas. S.Hashimoto (Dept. of Phys., Tokai Univ., Kanagawa, Japan), N.Yamaguchi.
Phys. Lett. A (Netherlands), vol.95A, no.6, p.299-302 (9 May 1983).
Red-shifts have been observed for Lyman-α lines of $Z=4$-7 ions at an electron density of 10^{21} cm^{-3}. The plasma was produced by a 0.1 TW 100 ps glass laser. The shift was measured relative to the line center of the spatially resolved unperturbed line. The results are compared with theory. (21 refs.)

71763 Features of lateral energy transport in CO_2-laser-irradiated microdisk targets. D.M.Villeneuve, G.D.Enright, M.C.Richardson (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Phys. Rev. A (USA), vol.27, no.5, p.2656-62 (May 1983).
Calorimetric investigations of the lateral flow of energy away from CO_2-laser-irradiated regions of disk targets are reported. The fraction of energy reaching the rear surface is shown to decrease with increasing target diameter, but does not depend on target thickness. Most of the plasma blow-off energy in front of the target is due to fast ions, but these account for less than 20% of the rear blow-off energy. The rear surface is heated preferentially at the edges, in the plane of laser polarization. These observations are consistent with energy being transported laterally by hot electrons inside the corona which expands at a speed of $\sim 10^8$ cm/s. (25 refs.)

Measured gain for XUV plasma lasers at varying pump intensities .... See Entry 71107

Thermophysical processes in the interaction of laser radiation with absorbing media .... See Entry 71160

Voltage pulse generation using CO_2 laser irradiated solid target plasmas .... See Entry 71165

Bremsstrahlung emission in a non LTE plasma .... See Entry 71704

Anomalously high absorption and anomalously strong scattering in a turbulent laser plasma .... See Entry 71732

Damping of large-amplitude plasma waves propagating perpendicular to the magnetic field .... See Entry 71743

Ignition of a laser target by a focused shock wave .... See Entry 71764

Evidence of anomalous multiplet line shapes in optically thick, laser-produced plasmas .... See Entry 71796

52.50L Plasma production and heating by shock wave and wire explosion

71764 Ignition of a laser target by a focused shock wave. V.A.Shcherbakov.
Fiz. Plazmy (USSR), vol.9, no.2, p.409-11 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
Some aspects of the problem of thermonuclear ignition by a focused shock wave and heating of a previously compressed spherical target is examined. In particular for a target of a mass $m \approx 400$ μg of DT_3 mixture (for a target with a DT density $p_o = 0.1$g/cm^3 the initial radius $r_0 = 1$ mm) previously compressed to a density for 40 g/cm^3, the compression velocity μ necessary for its ignition by a focused shock wave $\approx (1.5$-$1.6) \times 10^7$ cm/sec; the deposition of energy in the target at the ignition point is $E \approx 30$ kJ, and the thermonuclear energy released during heating (for a freely moving target) $Q \approx 50$ MJ, so that the coefficient of thermonuclear amplification $k = Q/E_{las} \approx 1600$ (since only a small part ~10% of the laser energy is transferred to the target, the ratio of thermonuclear energy to laser energy will be of course, considerably less). (6 refs.) *A.G.C.*

52.55 PLASMA EQUILIBRIUM AND CONFINEMENT

71765 Electrostatic corrections to the electron magnetic-drift waves. Zhang Yang-zhung (Southwestern Inst. of Phys., Sichuan, China).
Chin. Phys. (USA), vol.3, no.1, p.21-2 (Jan.-March 1983). [received: May 1983]
An explanation is given for the apparent anomalous behavior of electron transport in the Tokamak experiment while ion transport appears to be classical. (5 refs.)

71766 Determination of the runaway-electron distribution function by cyclotron absorption in a Tokamak. A.V.Zvonkov, E.V.Suvorov, A.V.Timofeev, A.A.Fraiman.
Fiz. Plazmy (USSR), vol.9, no.2, p.314-18 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
It is shown that in a weakly relativistic region the runaway electron distribution function in Tokamak can be determined by measurements of the coefficient of absorption of electron cyclotron oscillations. Probing of the plasma should be carried out in the vertical direction. (13 refs.) *A.G.C.*

71767 Internal helical instabilities in a Tokamak with anisotropic plasma. A.B.Mikhailovskii.
Fiz. Plazmy (USSR), vol.9, no.2, p.326-35 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
A theoretical study is presented of internal helical instabilities in a Tokamak with anisotropic plasma, which is of interest in connection with the injection into Tokamak of a beam of fast neutral atoms and the use of HF-heating of plasma. Stability criteria are derived for the first mode ($m=1$), and for higher modes $m>1$. It is shown that anisotropy is most significant for disturbances with $m=1$, and that for $m=1$ it can lead to a specific anisotropic helical instability. The effect of high plasma pressure on this instability is examined, and it is shown that it is stabilized if the average pressure of the plasma is large compared with the average pressure of the poloidal magnetic field. (9 refs.) *A.G.C.*

71768 Plasma heating experiments at the second harmonic of the electron cyclotron resonance in the T-10 Tokamak. V.V.Alikaev, L.I.Agapov, Yu.I.Arsen'ev, A.B.Berliozov.
Fiz. Plazmy (USSR), vol.9, no.2, p.336-42 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
Results are presented of a study of plasma heating in Tokamak T-10 at the second harmonic of the electron cyclotron resonance. During the introduction of microwave power of mixed polarization, an increase in the electron temperature at the centre of the plasma column $\simeq 500$eV is obtained. The heating efficiency is 50-60% in regimes with power being introduced of $P \simeq 500$kW and electron densities of $\bar{n}_e \simeq 3 \times 10^{13}$ cm^{-3}. The absence or the very weak dependence of electron thermal conductivity on T_e is demonstrated. (6 refs.) *A.G.C.*

71769 Magnetic system of the TO-2 Tokamak with divertor. L.I.Artemenkov, A.P.Popryadukin, A.N.Chudnovskii.
Fiz. Plazmy (USSR), vol.9, no.2, p.343-50 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The results of a study of the vacuum magnetic field of the TO-2 racetrack Tokamak with two toroidal divertors located in the straight sections are reported. The geometric characteristics of the TO-2 Tokamak are presented, and results of calculations of the parameters of the magnetic system, the location of the separatrix, the characteristics of the divertor, and other matters are discussed. Calculated characteristics are compared with experimentally measured values obtained by a method using the transmission of an electron beam in argon and are found to be in agreement. (4 refs.) *A.G.C.*

71770 Ideal MHD ballooning modes in toroidal magnetic traps with shear. A.B.Mikhailovskii, V.V.Demchenko, A.Ya.Omel'chenko.
Fiz. Plazmy (USSR), vol.9, no.2, p.351-6 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
A formalism is developed which allows ballooning modes in a wide class of equilibrium toroidal magnetic configurations with shear to be studied, among which are Tokamaks with arbitrary transverse cross-section shape, closed traps with a spatial magnetic axis and various equilibrium stellarators with helical windings. The stability criteria for ballooning modes in the simplest traps with spatial magnetic axis is a helical column. It is shown that for a given plasma pressure a certain value of shear exists for which the ballooning mode is less dangerous than disturbances of the Mercier type. (13 refs.) *A.G.C.*

71771 Radiative amplification of reversed field diffusion in a neutral layer during the formation of a compact toroid. V.N.Semenov, V.F.Strizhov.
Fiz. Plazmy (USSR), vol.9, no.2, p.401-8 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The dynamics of a current layer in a compact torus in the presence of impurities is examined. It is shown that intensive radiation losses in impurities can lead to rapid annihilation of counter-streaming magnetic fluxes in a time of the order of that observed in the experiments. Maximum permissible concentrations of carbon impurity in the discharge and the flow rate of plasma in the current layer are estimated for various parameters of the discharge. (6 refs.) *A.G.C.*

71772 Transverse ion losses in end stoppers of an ambipolar trap. L.S.Pekker.
Fiz. Plazmy (USSR), vol.9, no.2, p.420-33 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
Transverse losses of 'central' ions trapped in the end stoppers of an ambipolar trap are examined. These losses are associated with a marked elongation of the drift trajectory in the transverse direction and can significantly decrease the containment time of the plasma in the trap. A classification of the drift envelopes of trapped ions is presented, and the flux of these ions at the diaphragm is calculated. The influence of the 'reverse loss cone' instability is discussed, and also the effect of the radial electric field on plasma containment time. (17 refs.) *A.G.C.*

71773 Plasma formation in a gas-liner pinch. K.H.Finken, U.Ackermann (Inst fur Experimentalphys. V, Ruhr-Univ. Bochum, Bochum, Germany).
J. Phys. D (GB), vol.16, no.5, p.773-81 (14 May 1983).
A gas-liner pinch is optimised for Stark broadening investigations. To obtain the desired discharge conditions the gas injection, the preionisation and geometrical aspects of the discharge chamber are analysed. Quantitative agreement is found between the observed plasma compression and a 'snowplough' model. The density distribution of the compressed plasma column is derived from double exposure holograms. The peak electron density $N_e \approx 10^{18}$ cm^{-3}; the temperature gives $kT_e \approx 10$ eV. (10 refs.)

71774 Observation of radial equilibrium and transition to a helix of a gas-embedded *Z* pinch. A.E.Dangor, M.B.Favre Dominguez, S.Lee, E.Kahan (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England).
Phys. Rev. A (USA), vol.27, no.5, p.2751-4 (May 1983).
A laser-initiated, gas-embedded *Z* pinch is operated with a preheat current which adjusts the plasma parameters by Joule heating and expansion so that when the main current is injected, the plasma core is heated under conditions of pressure balance. This results in a pinch which has a constant radius during the time of current rise. The pinch is stable during this time and thereafter undergoes a rapid transformation into a radially expanding helical structure. The growth time and wavelength of the instability is in good agreement with the theoretical predictions of the $m=1$ magnetohydrodynamic instability. (10 refs.)

71775 Physics of non-neutral plasma. N.Rostoker, A.Fisher (Dept. of Phys., Univ. of California, Irvine, CA, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.293-7 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The theoretical basis for magnetic confinement is examined. Recent progress on confinement of pure electron plasma involves magnetic mirrors and simple toroidal configurations. This progress is described. Non-neutral configurations involving electrons and ions in mirror geometry are investigated. A basic experiment on mirror stability is proposed. (17 refs.)

71776 Present and future toroidal confinement experiments at Princeton Plasma Physics Laboratory. H.P.Furth (Plasma Phys. Lab., James Forrestal Campus, Princeton, NJ, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.324-35 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
A broad program of research on the confinement of plasma in nested toroidal magnetic surfaces is being carried out at the Princeton Plasma Physics Laboratory. Tokamak research at PPPL is progressing into the phase of technology development, in preparation for the support of a large-scale reactor-oriented effort. World-wide experimental research has brought the stellarator concept to the point of plasma-physical demonstration; at PPPL, the theoretical study of reactor-compatible stellarator design is yielding promising new results. Initial spheromak formation experiments have been successful. The confinement properties of the spheromak will begin to be studied experimentally during the next year. (43 refs.)

71777 The physics of mirror systems. R.F.Post (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.336-46 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
In recent years the emphasis in research on the magnetic mirror approach to fusion has been shifted to address what are essentially economically-motivated issues. The introduction of the tandem mirror idea solved in principle the problem of low Q (low fusion power gain) of mirror-based fusion systems. In order to optimize the tandem mirror idea from an economic standpoint, some important improvements have been suggested. These improvements include the thermal barrier idea of Baldwin and Logan and the axicell concept of Kesner. These new modifications introduce some special physics considerations. Among these are: (1) the MHD stability properties of high energy electron components in the end cells; (2) the optimization of end-cell magnetic field configurations with the objective of minimizing equilibrium parallel currents; (3) the suppression of microstabilities by use of 'sloshing ion' distributions. Following a brief outline of tandem mirror concepts, the above three topics are discussed, with illustrative examples taken from earlier work or from recent design studies. (29 refs.)

71778 The physics of spheromak. G.C.Goldenbaum (Lab. for Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.359-66 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The present state of understanding of spheromak physics is reviewed by comparing experimental results with MHD equilibrium and stability theory. (29 refs.)

71779 The physics of the dense Z-pinch in theory and in experiment with application to fusion reactor. M.G.Haines (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England).
Phys. Scr. (Sweden), vol.T2, no.2, p.380-90 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
A new generation of *Z*-pinches employing high voltage, high current pulsed lines as power sources produce dense hot plasmas with enhanced stability properties. Three methods of *Z*-pinch formation are currently in use: (1) cylindrical collapse and compression of a pre-ionised gas; (2) laser initiation and Joule heating of a gas embedded pinch; and (3) hollow gas puff and subsequent collapse to the axis. The first method shows no dynamic bounce and no instability over about ten radial Alfven transit times. The laser initiated *Z*-pinch shows benign helical structures, whilst the gas puff experiments are known for their high X-ray energy conversion associated with $m=0$ instabilities. The first two experimental conditions are relevant for fusion. A calculation of energy balance for satisfying Lawson conditions with axial and radial energy losses and radiation loss shows that a current I of $\sim 10^6$ A and a line density N of 6×10^{18} m^{-1} are required. This leads to two coincidences of physical quantities that are very favourable for controlled fusion. (29 refs.)

71780 Stability and confinement of spheromaks and field reversed configurations. W.E.Quinn (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.391-8 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
The formation, confinement and stability of two types of compact toroids, spheromaks and field reversed configurations (FRC), are reviewed. Spheromaks, which contain both toroidal and poloidal magnetic fields, have been formed with magnetized coaxial plasma guns, by a combination of Z- and θ-pinch techniques and by an electrodeless slow induction technique, and trapped in both prolate and oblate flux conservers. As predicted by theory, the prolate configuration is unstable to the tilt mode, but the oblate configuration with a conducting wall is stable. Configuration lifetimes of up to 0.8 ms are observed. The FRC is a high-beta, highly prolate compact toroid formed with field-reversed theta-pinch techniques and having purely poloidal magnetic field. Theory predicts unstable fluting and internal tilting modes, but they are not observed experimentally. Configurations with high densities $\sim 10^{15}$ cm^{-3} and with lifetimes of 50-120 μs are terminated by an $n=2$ rotational mode of instability. (51 refs.)

71781 REB injected toroidal plasma. A.Mohri, K.Narihara, Y.Tomita, M.Hasegawa, T.Tsuzuki, T.Kobata (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan).
Phys. Scr. (Sweden), vol.T2, no.2, p.399-404 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
A stable relativistic electron beam (REB) ring for plasma confinement was formed by REB injection with the help of image currents in a resistive shell, and then the ring was compressed in major radius by a factor 2.0. The current rise well obeyed the adiabatic scaling law. (13 refs.)

71782 Topics in reversed-field-pinch physics. H.Dreicer (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Scr. (Sweden), vol.T2, no.2, p.435-42 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).
Laboratory observations made on the reversed-field pinch (RFP) show that this magnetic confinement configuration exhibits 'metastable' minimum energy properties similar to those predicted by Taylor. The theoretical basis of the RFP is reviewed and compared with recent observations made on the Los Alamos ZT-40 RFP device. Particular emphasis is placed on the observation that the reversed field is regenerated by a dynamo-like mechanism for times large compared to the classical field diffusion time. (37 refs.)

71783 The Tokamak. H.P.Furth (Princeton Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
In book: *Fusion. Vol.1. Magnetic confinement. Part A*, E.Teller [Ed.], p.123-242. London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
The author provides a brief overview of the Tokamak field and therefore an introduction to the technical literature. He covers Tokamak configuration and confinement, heating methods and MHD stability and future Tokamak devices. (263 refs.)

71784 Stellarators. J.L.Shohet (Torastron-Stellarator Lab., Univ. of Wisconsin, Madison, WI, USA).
In book: *Fusion. Vol.1. Magnetic confinement. Part A*, E.Teller [Ed.], p.243-89. London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
A stellarator is a toroidal magnetic confinement device in which plasma confinement is achieved by generating closed toroidal magnetic surfaces, much like those appearing in a Tokamak. Unlike the Tokamak, stellarators generate their confining surfaces entirely by means of currents flowing in external conductors. The author gives a general introduction to stellarators and their variations, such as torsatrons, heliotrons, figure-eights etc. Particle orbits, transport, equilibrium and stability for these configurations are discussed and some specific comments on the present-day status of experiments and a view of reactor implications are included. (62 refs.)

71785 Mirror theory. T.K.Fowler (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
In book: *Fusion. Vol.1. Magnetic confinement. Part A*, E.Teller [Ed.], p.291-355. London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
Magnetic mirror devices differ from Tokamaks in the shape of the magnet. All magnetic fusion approaches can be divided into two types. One is the toroidal or 'closed' type in which magnetic lines remain within the plasma volume; Tokamaks are toroidal. The other is the linear or 'open' type in which field lines escape out the ends. The plasma also escapes unless the ends are 'plugged' up by some means. Far the most successful means of end plugging has been the magnetic mirror effect. The author describes the basic mirror concept, both for its own interest and as a background for understanding the new ideas now unfolding, and the tandem mirror concept which derives naturally from it. He also mentions mirror stability theory, mirror reactors and the field-reversed mirror. (77 refs.)

71786 Experimental base of mirror-confinement physics. R.F.Post (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
In book: *Fusion. Vol.1. Magnetic confinement. Part A*, E.Teller [Ed.], p.357-435. London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
The author discusses some of the more important steps in the experimental work carried out to confine high-density plasmas at fusion temperatures. (59 refs.)

71787 The reversed-field pinch. D.A.Baker, W.E.Quinn (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
In book: *Fusion. Vol.1. Magnetic confinement. Part A*, E.Teller [Ed.], p.437-475. London, England: Academic Press (1981), xiii+491 pp. [0 12 685201 4]
The pinch effect, which is the self-constriction that occurs in a plasma as a result of the passage of a unidirection current, is one method of plasma heating and confinement. The authors review the method of producing reversed field pinch (RFP) configurations, stability theory and RFP experiments. (123 refs.)

Fusion. Vol.1. Magnetic confinement. Part A .... See Entry 69800

The JET scientific programme and perspectives in the European fusion programme .... See Entry 70724

Physics requirements for a Tokamak Engineering Test Reactor .... See Entry 70725

Experiments with pure electron plasmas .... See Entry 71700

Lower hybrid current derive and sustainment in WT-2 Tokamak .... See Entry 71701

High-resolution X-ray spectra from molybdenum ions in the Alcator-*C* Tokamak .... See Entry 71706

Current drive experiments on the PLT Tokamak .... See Entry 71729

Early history .... See Entry 71730

Tokamak plasma stability .... See Entry 71731

On the transition to turbulence in magneto-hydrodynamic models of confined plasmas .... See Entry 71734

Plasma boundary layer in limiter and divertor Tokamaks .... See Entry 71749

Plasma heating by rotating relativistic electron beams .... See Entry 71752

Distortion of the distribution function of weakly RF heated minority ions in a Tokamak plasma .... See Entry 71755

Electron cyclotron heating of a Tokamak plasma .... See Entry 71756

Plasma density measurements in a fast linear theta-pinch by absolute intensity measurements of bremsstrahlung .... See Entry 71793

Electron temperature measurement by Thomson scattering in Tokamak NOVA II .... See Entry 71797

Plasma boundary diagnostics by laser induced fluorescence ......See Entry 71799

Density fluctuation measurement by infrared light scattering ..See Entry 71800

52.60 RELATIVISTIC PLASMA

71788 Longitudinal oscillations in a relativistic plasma. B.K.Shivamoggi (Dept. of Theoretical Phys., Australian Nat. Univ., Canberra, Australia).

Fizika (Yugoslavia), vol.15, no.1, p.83-92 (Jan.-March 1983).

Longitudinal oscillations in a relativistic plasma are studied. First a three-dimensional space+time approach (which is not manifestly covariant) is used. An approximate evaluation of the dispersion relation for the case of a weakly-relativistic plasma is then made. The problem of two-stream instability in a relativistic plasma is discussed, and the relativistic effects are shown to have a stabilising nature on the problem. Next, these treatments are repeated using a manifestly-covarient four dimensional space-time approach, and attention is drawn to discrepancies in the results deduced by these two approaches. (6 refs.)

71789 Action principle for a hot plasma in curved space-time. H.Heintzmann (Inst. fur Theoretische Phys., Univ. zu Koln, Koln, Germany), M.Novello.

Phys. Rev. A (USA), vol.27, no.5, p.2671-81 (May 1983).

A manifestly covariant extension of the Low-Sturrock Lagrangian is formulated and its invariance properties are investigated. In particular the authors clarify the meaning of particle displacements which play the role of the configuration variables of the variational principle in general relativity. As a consequence of the variational principle the authors derive a conservation law for Witham's (1970) wave-vector action in the WKB approximation. (30 refs.)

The stability of the relativistic Alfven waves ....See Entry 71713

Plasma heating by rotating relativistic electron beams ....See Entry 71752

Physics of REB-plasma interaction ....See Entry 71753

REB injected toroidal plasma ....See Entry 71781

52.65 PLASMA SIMULATION

Computer simulation of plasma turbulence in open systems .... See Entry 71733

Electron cyclotron heating of a Tokamak plasma .... See Entry 71756

52.70 PLASMA DIAGNOSTIC TECHNIQUES AND INSTRUMENTATION

71790 Transportation of far-IR bemas for use in plasma diagnostics. M.R.Siegrist, I.Kjelberg, R.Behn (Centre de Recherches en Physique des Plasmas, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).

Appl. Opt. (USA), vol.22, no.9, p.1318-24 (1 May 1983).

In this paper the authors discuss certain aspects concerning the transport and focusing of a high power far-IR laser beam into a plasma for Thomson scattering measurements. To attain the required megawatt power level in a D_2O laser, it is important to use efficiently the volume of the optically pumped vapor. The best known method to achieve this is use of an unstable resonator which produces a beam with an annular intensity profile. This has a negative effect on the quality of the focused beam and on the intensity profile incident on the beam dump. A system utilizing a Cassegrainian telescope and spatial filtering techniques is found to be a good solution. (9 refs.)

71791 Bringing JET on line [nuclear research]. R.Norton (Norsk Data Ltd., Newbury, England).

Comput. Syst. (GB), vol.3, no.5, p.41-5 (May 1983).

Describes the control and data acquisition system (CODAS), for the Joint European Torus nuclear fusion experiment. CODAS is based on a distributed system of 27 Norsk Data computers. (no refs.)

71792 Cooled spherical electrostatic probe with a thin collisionless layer. A.V.Norin.

Fiz. Plazmy (USSR), vol.9, no.2, p.300-7 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*

A theoretical model is proposed for calculating the volt-ampere characteristics of a quiescent cooled spherical probe operating in a regime when the mean free path length of charged particles exceeds the Debye radius but is considerably less than the dimensions of the probe. In the model all regions of the plasma are divided into two zones which require quantitatively different descriptions, a collisionless pre-zone layer and a diffusional zone. It is shown that with a reduction in the temperature of the probe the current in the probe is decresed. Relationships are constructed for the floating potential vs. temperature of the probe for an argon plasma. For saturation currents expressions are derived in analytic form which in the limiting case of a thermostatic probe in a continuous media transform into expressions derived from the continuum theory of Su and Lamb (1963). (9 refs.) *A.G.C.*

71793 Plasma density measurements in a fast linear theta-pinch by absolute intensity measurements of bremsstrahlung. V.A.Burtsev, B.V.Lyublin.

Fiz. Plazmy (USSR), vol.9, no.2, p.308-13 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*

A method is described for measuring the density of plasma by the absolute intensity of bremsstrahlung in the visible region of the spectrum. The technique of absolute calibration of the measuring apparatus is examined in detail, and estiamtes are made of the accuracy of the measurements. Results of determinations of the density of plasma in the 'UTRO' apparatus are reported. A radial profile of the density constructed by the method of Pierce is presented. Densities at the profile maximum are 10^{17} and 2.10^{17} cm^{-3} at initial pressures of 0.4 and 1.0 torr respectively. (9 refs.) *A.G.C.*

71794 Mobile probe for examining a dense plasma. V.N.Kovalev, A.A.Lyapin, M.M.Chursin.

Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.979-81 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.180-1 (July-Aug. 1982). [received: May 1983]

A description is given of a mobile probe for diagnosing dense plasma that enables one to measure the distributions of the major parameters along the radius at each pass. The probe speed is 20-1000 mm/sec, the time spent in the plasma ranging from 20 msec to 2 sec. (2 refs.)

71795 Characteristics of a photodiode matrix for use with weak light fluxes. G.I.Aponin, A.A.Besshaposhnikov, V.B.Voronin, D.M.Kulakov, A.D.Petrova, N.V.Simonova.

Instrum. & Exp. Tech. (USA), vol.25, no.4, pt.2, p.981-4 (July-Aug. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.4, p.182-4 (July-Aug. 1982). [received: May 1983]

The characteristics of an MIF-15 integrated MIS photodiode matrix are given in relation to the parameters of the optical radiation and the working conditions. The results indicate that the matrix can be used as a detector with weak light fluxes, in particular in recording the scattered radiation in research on plasma with an electron concentration $N=10^{16}$-10^{18} cm^{-3}. (5 refs.)

71796 Evidence of anomalous multiplet line shapes in optically thick, laser-produced plasmas. D.Santi, P.Nicolosi (Centro di Studio sui Gas Ionizzati, Univ. di Padova, Padova, Italy).

J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.549-52 (June 1983).

Reports observations of anomalous line shapes for the transitions $2p$-$3d$ (^2P-^2D) emitted by the Li-like ions N(V), O(VI), F(VII) in laser-produced plasmas. These transitions are normally doublets but show completely different characteristics (e.g. triplet structures or inversion of two-component intensity ratios) in the plasmas. The observed line profiles are accounted for in terms of opacity and Doppler effect produced by plasma expansion. This interpretation is independent of the particular transition involved, i.e. multiplet structures can generate more complicated features with various unexpected new components, anomalous intensity ratios, etc. (7 refs.)

71797 Electron temperature measurement by Thomson scattering in Tokamak NOVA II. S.Masamune, I.Yokoyama, M.Fukao, H.Nishihara (Dept. of Nuclear Engng., Kyoto Univ., Kyoto, Japan).

Mem. Fac. Eng. Kyoto Univ. (Japan), vol.44, pt.4, p.451-9 (Oct. 1982). [received: May 1983]

The Thomson scattering method was applied to determine the temperature and density profiles of plasma electrons in the NOVA II Tokamak. The radial profile of electron density has been found to be approximately parabolic, while the temperature profile appeared more peaky and can be represented by the square of the parabolic expression. The electron energy confinement time determined by this method is in good agreement with that predicted by the Alcator scaling law. (10 refs.)

71798 Temperature measurement of an N_2 glow discharge by emission spectroscopy. A.Plain, A.Ricard (Lab. de Phys. des Gaz et des Plasmas, Univ. Paris-Sud, Orsay, France).

Phys. Lett. A (Netherlands), vol.95A, no.5, p.235-8 (2 May 1983).

The rotational temperature (T_R) of a cold N_2 glow discharge was deduced from the intensity distribution of the $N_2(^3\Pi_u, \nu'=0 \rightarrow B^3\Pi_g, \nu''=0)$ $\lambda=337.1$ nm R-branch. Likewise, the neutral temperature (T_g) was measured with a thermocouple located on the axis of the discharge. It is shown that $T_R=T_g$ for $300<T_g<700$K. (10 refs.)

71799 Plasma boundary diagnostics by laser induced fluorescence. E.Hintz (Inst. fur Plasmaphys., KFA Julich GmbH, Julich, Germany).

Phys. Scr. (Sweden), vol.T2, no.2, p.454-8 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).

For an efficient control of the effects of plasma surface interaction improved diagnostics of the plasma edge region is needed. Laser induced fluorescence offers the possibility to measure the density, the velocity distribution and the flux density of neutral and ionized particles with good time and space resolution. In contrast to currently used probes it does not disturb the plasma and is not affected by it. A survey on results obtained with this technique in Tokamaks and other magnetic confinement devices is presented. It is shown that fluxes of metal atoms emitted by the wall can be determined with good accuracy. In addition important information on processes of plasma surface interaction can be obtained. From the measured spatial distribution of particle densities the ionization length as well as T_e can be derived and knowledge about the structure of the scrape off layer is gained. Using laser induced fluorescence on injected beams of suitable chosen metal atoms, n_e and T_e can be determined in the boundary layer even at low n_e. Present limits of the method with respect to type and density of species to be detected and future prospects are discussed. (22 refs.)

71800 Density fluctuation measurement by infrared light scattering. D.Gresillon, C.Stern, A.Hemon, A.Truc, T.Lehner (Ecole Polytech., Palaiseau, France), J.Olivain, A.Quemeneur, F.Gervais, Y.Lapierre.

Phys. Scr. (Sweden), vol.T2, no.2, p.459-66 (1982). [received: April 1983] (1982 International Conference on Plasma Physics, Goteborg, Sweden, 9-15 June 1982).

Density fluctuation observation can be obtained by scattering of electromagnetic radiation. New developments and applications are presented. By heterodyne detection the scattered signal is shown to be the time variation of a space Fourier transform of the density. The antenna beam, that especially defines the sensitivity, is experimentally investigated. The time variation is used in two occurrences, to check quantum efficiency uniformity on detectors area, and in an air turbulence where the interspectrum is obtained between two scattering devices looking at different regions. Calibration formulas are given for quantitative measurement of density fluctuation spectrum. Observations are also reported on a Tokamak plasma on the drift wave spectrum, and on a new second order group of oscillations that were observed during ion cyclotron radiofrequency heating. The analysis shows this new group is a forced oscillation by beating of the drift waves with the high-frequency heating wave, and its amplitude provides a measurement of the HF wave electric field. (20 refs.)

A soft X-ray streak camera ....See Entry 70159

Quantitative intensity measurements using a soft X-ray streak camera ....See Entry 70160

Oscillator strengths of neutral and singly ionised molybdenum ....See Entry 70820

Improved Ar(II) transition probabilities ....See Entry 70821

Plasma—Particle momentum and heat transfer: modelling and measurements .. ..See Entry 71692

Magnetic field line reconnection experiments .... See Entry 71699

The infrared emission spectrum of an argon plasma jet between 4 and 25 microns ....See Entry 71702

Bremsstrahlung emission in a non LTE plasma .... See Entry 71704

Plasma shifts of the Lyman lines to shorter wavelengths in C VI ....See Entry 71705

Experimental determination of the velocity and width of plane ion-acoustic solitons propagating in a plasma ....See Entry 71725

Aspects of the physics of laser-plasma interactions .... See Entry 71744

Physics of REB-plasma interaction ....See Entry 71753

Spectral study of a carbon laser plasma expanding into a background medium ....See Entry 71760

Determination of the runaway-electron distribution function by cyclotron absorption in a Tokamak .... See Entry 71766

Investigations of the turbulent flow field in a high-speed plasma jet enclosed in a vessel ....See Entry 71801

Characteristics of a transferred-arc plasma ....See Entry 71809

52.75 PLASMA DEVICES AND APPLICATIONS

(see also 28.52 Fusion reactors, 86.30L Electrogasdynamic and magnetohydrodynamic conversion; for ion sources, see 29.25 Particle sources and targets)

71801 **Investigations of the turbulent flow field in a high-speed plasma jet enclosed in a vessel.** E.Hayess (Zentralinst. fur Elektronenphys., Akad der Wissenschaften, Institutsteil IV, Berlin, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.133-44 (1983). In German.
The spatial distribution of temperature and velocity in a turbulent plasma jet enclosed in a large diameter tubular vessel has been measured with thermocouple probes and dynamic pressure probes and corrected by an iterative computation method. The results show that the behaviour of the plasma jet in principle is not different from the behaviour of an ordinary gas jet or a flame. Due to the mass entrainment from surroundings, the jet is divergent and died out very rapidly. On account of conservation of mass, the author expects a retrograde motion of the gas at the wall of the tubular vessel. Because the corresponding velocity is very small it falls below the detection limit of the measurement system. (31 refs.)

71802 **Plasma technologies for powder particles.** E.Kranz (Tech. Hochschule Ilmenau, Ilmenau, Germany).
Elektrie (Germany), vol.37, no.3, p.142-4 (1983). In German.
A survey of principles, properties, and applications of plasma spraying and powder transformation and generation in plasma is given, together with grain size transformation, powder particle formation, power reduction, and melting. They are effected within the power range of 10^3 to 10^7 W, mostly in plasma reactors. The product application is made in nuclear engineering for hard material production, reflector surfaces, filters, fillers, pigments, phase stabilization, metallurgy, and semiconductor techniques, and is of great industrial importance. (2 refs.)

71803 **State of the plasma cutting in GDR.** H.Forster, P.Wiese.
Elektrie (Germany), vol.37, no.3, p.149-54 (1983). In German.
Plasma cutting equipment with the power range of 3 to 100 kW have been developed in the GDR. These equipments are working in production at home and abroad. Metallic materials up to 150 mm in thickness may be cut by machine or by hand. Especially, the great cutting velocities are of advantage, making possible the coupling with the most modern directing machines. Examples are discussed in detail, showing how the light, noise and damaging material loads appearing during plasma cutting may be reduced to unobjectionable values through protective measures. (11 refs.)

71804 **Two-dimensional plasma model for the arc-driven rail gun.** J.D.Powell (Ballistic Res. Lab., USA ARRADCOM, Aberdeen Proving Ground, MD, USA), J.H.Batteh.
J. Appl. Phys. (USA), vol.54, no.5, p.2242-54 (May 1983).
A previously developed one-dimensional model for studying the fluid-mechanical electrodynamical properties of the plasma in an arc-driven rail gun is extended to two dimensions. The analysis includes deriving a set of general, time-dependent equations, the solution of which yields the associated properties of the arc. These equations are then solved under the assumptions that the flow variables are steady in a frame of reference which accelerates with the arc, and that the effect of the arc's acceleration upon these variables can be neglected. Numerical calculations are carried out to analyze arcs in recent experiments. In addition to the numerical calculations, some approximate analytic solutions, which are applicable under certain limiting conditions, are also worked out. These limiting-case solutions are then used to derive a set of scaling relations which indicate how the arc properties vary with gun size, projectile mass, and acceleration characteristics. Considerable discussion of the assumptions and the results is given emphasizing particularly the physical reasons for the differences with previous one-dimensional calculations. (18 refs.)

71805 **Efficiency and erosion characteristics of plasma jet igniters.** P.R.Smy (Faculty of Engng., Univ. of Alberta, Edmonton, Alberta, Canada), R.M.Clements, J.D.Dale, D.Simeoni, D.R.Topham.
J. Phys. D (GB), vol.16, no.5, p.783-91 (14 May 1983).
The rate of erosion of both ceramic and metal in a typical plasma jet igniter has been monitored as a function of various experimental parameters. Even under the most favorable conditions it appears that working lifetimes may be limited to the order of ten hours—a figure in line with previous measurements of arc erosion. Direct measurements of the thermal energy delivered by the igniter to the adjacent gas reveal that overall efficiencies $\sim 10\%$ are attained. In order to minimise erosion while maintaining a given delivery of thermal energy it is found essential to work with low initial voltages on the energy storage capacitor. (12 refs.)

71806 **Interaction of finely dispersed particles with the column of a constricted arc.** S.P.Polyakov (Dnepropetrovsk Metall. Inst., Dnepropetrovsk, Ukrainian SSR).
J. Eng. Phys. (USA), vol.43, no.2, p.933-5 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.303-6 (Aug. 1982). [received: April 1983]
It is shown that when particles of powder interact with the column of a constricted arc, in a plasmotron nozzle channel, repulsive forces are created. (6 refs.)

71807 **High-power narrowband millimeter waves generated by the electron beam emitted from the plasma focus.** K.Schmitt, H.Krompholz, F.Ruhl, G.Herziger (Inst. fur Angewandte Phys., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.239-41 (2 May 1983).
High-power narrowband millimeter-wave pulses ($P \approx 1$ MW, $\Delta f/f < 5 \times 10^{-2}$, duration <600 ps) have been observed at a 1.6 kJ plasma focus. The microwaves are generated in the frequency range 30 GHz$<f<$120 GHz by a periodic train of electron bunches emitted from the plasma. The power of the harmonics $2f$ and $3f$ indicates width of the electron bunches below 4 ps and a maximum diameter of the beam of 1 mm. (7 refs.)

71808 **Plasma cutting.** K.A.Bunting (Electricity Council Res. Centre, Capenhurst, England).
Colloquium on New Tools for Industrial Processes, London, England, 14 April 1983 (London, England: IEE 1983), 1 pp.
Summary form only given. Discusses the development of a supersonic, non-transferred, d.c. plasma jet. The commercial rationale for its development is briefly discussed. There are two main types of plasma jet which can be used for cutting, these are compared. The cut speed in any material is determined by the power density incident upon the material, the jet or beam diameter and the thermal properties of the material. A relationshp and families of curves derived from it for copper and iron are presented. It is shown that high power densities are required in order to be able to cut metal foils without distortion. (no refs.)

Voltage pulse generation using CO_2 laser irradiated solid target plasmas ....See Entry 71165

Plasma—Particle momentum and heat transfer: modelling and measurements ....See Entry 71692

The infrared emission spectrum of an argon plasma jet between 4 and 25 microns ....See Entry 71702

Magnetic system of the TO-2 Tokamak with divertor ....See Entry 71769

The Tokamak ....See Entry 71783

52.80 ELECTRIC DISCHARGES

(see also 51.50 Electrical phenomena in gases)

71809 **Characteristics of a transferred-arc plasma.** M.T.Mehmetoglu, W.H.Gauvin (McGill Univ., Montreal, Quebec, Canada).
AIChE J. (USA), vol.29, no.2, p.207-15 (March 1983).
The basic characteristics of a transferred arc argon plasma were determined using a cathode assembly suitable for transferring the electric arc to a molten metal bath or to a cooled anode. They indicated that the sustained voltage depended strongly on the arc length and much less on current. The inlet gas velocity past the cathode tip was determined to be an important operating parameter, rather than the volumetric gas flowrate. The measurement of the axial and radial profiles of temperature was effected with $\pm 8\%$ accuracy by a novel diagnostic technique. Temperatures up to 18500K were observed on the axis of the plasma column, near the cathode tip, and decayed in both radial and axial directions. A sweeping microprobe was used to measure the axial and radial profiles of velocity. Velocities up to 190 m/s were recorded. The presence of a relatively colder flow surrounding the plasma column was detected. Mass and energy balances performed by taking this flow into account agreed with the measured input rates. (32 refs.)

71810 **Explosive electron emission and formation of a cathode spot in pulsed volume discharges.** S.A.Genkin, Yu.D.Korolev, G.A.Mesyats, A.P.Khuzeev.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.84-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1306-9 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Investigation of the conversion of a pulsed volume discharge of enhanced pressure into a spark discharge has established that in most cases the transition occurs in two stages: first a cathode spot forms, and then a high-conductivity channel develops from the spot. The authors demonstrate the relationship between the modes of combustion of the discharge in the volume phase and the behavior of the cathode spot. They indentify regions of parameters of the volume discharge with respect to the field strength in the column and the current density, which manifests effects associated with the specific behavior of the spot (current cutoff, propagation of spots over cathode surface, regular arrangement of spots). They study the volume discharge in nitrogen at a pressure of 100 mm Hg, with the voltage on the gap below the breakdown value, was initiated by a beam of fast electrons with a duration of 100 nsec. (9 refs.)

71811 **Experimental investigations of axial pressure gradients in low-pressure discharges at high current.** W.Ebert (Phys.-Tech. Inst., Akad. der Wissenschaften, Jena, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.153-63 (1983). In German.
Measurements of the axial pressure in low-pressure discharges at high currents have been carried out. It was possible to show, that the axial pressure in the discharge tube is mainly determined by the volume of the cathode-bulb or the anode-bulb volume and not by the discharge current or the filling pressure. For the case, that the volume of the anode-bulb was very large in comparison with the cathode-bulb, the pressure in the discharge tube was nearly constant (grad $p \approx 0$). The results of these experiments are in agreement with numerical calculations. (6 refs.)

71812 **Formation of AC discharges between glass insulated electrodes in Ne+1% N_2 mixtures. I. Experiments and analysis.** W.Stern (Akad. der Wissenschaften, Gasentladungsphys., Greifswald, Germany), H.Lange.
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.165-80 (1983).
AC plasma displays made use of medium pressure AC discharges in Penning mixtures between insulated electrodes. Discharges in Ne+1%N_2 with glazed electrodes are a suitable experimental model showing the characteristic pulse and continuous discharge modes. The axial optical space time structure of sinus wave sustained model discharges are measured with a scanning device, obtaining characteristic phases of discharge formation. Application of luminous flux method for stationary and dynamic Townsend discharges yields the first Townsend ionization coefficient α, and the comparison of the optical structure of AC discharges with that of DC discharges allows to explain the axial structure and to estimate the space charge effects. (36 refs.)

71813 **Analysis of the kinetic properties and the energy budget of the electrons in the Ar-Hg glow discharge plasma at varying partial pressures and discharge currents.** R.B.Winkler, J.Wilheim, R.Winkler (Zentralinst. fur Elektronenphys., Gasentladungsphys., Rudolf-Seeliger, Greifswald, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.1, p.25-40 (1983).
By simultaneously solving the Boltzmann equation and the current balance for the electrons the energy distribution function, the electron concentration and resulting macroscopic electron quantities were calculated for the Ar-Hg mixture plasma under conditions typical of fluorescent lamps. Besides the usual external parameters of such diffusion determined discharge plasmas measured values of the electric field strength were employed. The investigations were performed for independent variation of the partial pressures of Ar and Hg as well as of the discharge current in wide ranges of practical interest. The results obtained are discussed and compared with various energy distributions employed up to now and measured values of the electron concentration and temperature as well as with experimental results on the energy budget of this mixture plasma available in the literature. (8 refs.)

71814 **The construction of systems of equations describing gas discharges containing several species of atoms and ions, including stepwise processes, negative ions, and the spatial variation of the temperatures.** H.-B.Valentini (Zentralinst. fur Elektronenphys., Akad. der Wissenschaften, Jena, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.1, p.51-66 (1983).
The sets of differential equations usually used for the description of the low pressure discharges are underconstrained if several species of atoms and of ions and stepwise processes are taken into consideration. Using the equations of continuity, of momentum transfer, and of energy transfer for each species it is shown that, besides known closing statements for these sets of differential equations, additional conditions are necessary. It is found that the following relatively simple condition is sufficient for positive ions. The radial pressure gradient has to be assumed to vanish at least with the third order as the distance from the axis approaches zero. Various simpler and also more accurate and cumbersome approximations describing non-excited atoms, positive

and negative ions are investigated. Under some conditions one can formulate additional boundary conditions at the wall instead of additional conditions on the axis. (26 refs.)

71815 **Ion-acoustic instabilities of DC discharges in rare gases at low pressures. II. Experimental results in comparison with a one-dimensional kinetic dispersion theory.** R.Leven (Sektion Phys./Elektronik, Ernst-Moritz-Arndt-Univ., Greifswald, Germany), A.Konig.
Beitr. Plasma Phys. (Germany), vol.23, no.1, p.67-76 (1983).
For pt.I see ibid., vol.20, p.129 (1980). The experimental measurements of the propagation properties of self-excited ion acoustic waves in a DC-low pressure column are compared with a one dimensional dispersion theory. The corresponding dispersion relation is developed starting from the linearised Vlasov equation with a Davydov-type collision term. It is shown, that the mean features of the propagation behaviour of the ion acoustic waves can be explained by the theory. The experimental results concerning the dependence of the upper limit frequency of the waves upon the discharge current should be analysed on the base of new results from plasma diagnostics, taking also into account nonlinear and geometrical effects. (10 refs.)

71816 **The state of the theory of vacuum arc cathodes.** E.Hantzche (Zentralinst. fur Elektronenphys., Akad. der Wissenschaften, Berlin, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.1, p.77-94 (1983).
The physics of vacuum arc cathodes, the advances in their interpretation and the still unsolved problems are summarized. Starting from the experimental experiences the theories of stationary arc spots are described, with their assumptions and variants, their successes and deficiencies. It is shown that an extension of these models by inclusion of non-stationary processes is inevitable. Such processes are suggested and their importance in a theory of the dynamic arc spot is investigated. Finally the role of surface contaminations is discussed, and the general applicability of the vacuum arc models to all kinds of arc electrodes is emphasized. (108 refs.)

71817 **To the energy relations of partial discharges in dielectrics.** A.Veverka.
Elektrotech. Obz. (Czechoslovakia), vol.72, no.4, p.179-81 (April 1983). In Czech.
A relation for the calculation of the power consumed in partial discharges is deduced. Its use makes it possible to determine the power if one were to measure the effective value of voltage on the object, the initial discharge voltage (instantaneous value) on the sine voltage curve of the object and the sum of all charges supplied to the object in one half period of voltage. (2 refs.)

71818 **Discharge behaviour of large electrodes, affected with impurities in air during positive switching voltage.** E.Engelmann (Sektion Elektrotech., Tech. Univ. Dresden, Dresden, Germany).
Elektrie (Germany), vol.37, no.4, p.179-83 (1983). In German.
The ignition conditions and spatial time development of streamer discharges, the streamer discharge-leader discharge transition and the disruption behaviour are described by considering the stochasticity of the discharge processes in sphere-plate-gaps of several metres and the different macro- and micro-geometries of the electrodes. From this data, a technical-physical model of the discharge behaviour of electrodes with impurities is derived. (12 refs.)

71819 **Influence of the temporal voltage curve on the discharge behaviour of large electrode systems, affected with impurities, in air.** S.Laub (Sektion Elektrotech., Tech. Univ. Dresden, Dresden, Germany).
Elektrie (Germany), vol.37, no.4, p.184-9 (1983). In German.
Starting from experimental investigations during switching and lightning voltages, the influence of the effective time and the temporal curve of the electrode voltage on the discharge ignition, the spatial-time discharge development and the disruptive behaviour of large electrode systems, affected with impurities, is further clarified. It appears that the influence of the voltage mode on the discharge processes has to be considered always against the macro- and micro-geometries of the electrodes. Among other things the resulting knowledges shall help to dimension extra-high voltage testing plants in the future with much more safety and to interpret correctly the readings from the plants. (11 refs.)

71820 **Mechanism for the development of the ionization instability in a nonself-sustained gas discharge plasma.** A.S.Kovalev, A.M.Popov, A.T.Rakhimov, N.V.Suetin.
Fiz. Plazmy (USSR), vol.9, no.2, p.392-6 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
The mechanism of the development of an instability formed initially in pre-electrode layers and subsequently propagating to the opposite electrode of a highly conducting channel is investigated. The connection of the proposed mechanism with known volume instabilities is examined. An approximate relationship for the velocity of penetration of the channel to its length and parameters of the discharge is found. (15 refs.) *A.G.C.*

71821 **Theory and calculation of stationary optical breakdown of atomic gases close to the surface of refractory metals.** A.A.Vedenov, G.G.Gladush, A.N.Yavokhin.
Fiz. Plazmy (USSR), vol.9, no.2, p.434-40 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
Low-threshold optical breakdown of atomic gases close to refractory metals is studied analytically and numerically in the framework of a thermal model. It is shown that marked heating of electrons in relation to atoms of the surrounding gas and to the vapour of the metal substantially reduces the breakdown threshold compared with molecular gases. The relationship of the breakdown power density to the temperature of the target, the type of gas and the focusing of the spot is analysed. (11 refs.) *A.G.C.*

71822 **Current density for cold cathode discharge gap in rare gases.** R.Lagushenko, J.Maya (GTE Products Corp., Danvers, MA, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2255-60 (May 1983).
The authors report experimental current density results for tungsten and yttrium cold cathode discharge gap (j, AC, and DC) as a function of pressure (P_{RG}) for He, Nr, Ar, and (99.9%Ne+0.1% Ar) at 100-220 V. They calculated the discharge gap parameters both for AC and DC cases and compared them to experimental results. Conclusions drawn from this comparison are discussed. (5 refs.)

71823 **Modelling of the low-pressure argon positive column.** C.M.Ferreira (Centro de Electrodinamica, Univ. Tecnica de Lisboa, Lisboa, Portugal), A.Ricard.
J. Appl. Phys. (USA), vol.54, no.5, p.2261-71 (May 1983).
The properties and operating characteristics of the positive column of a low-pressure positive column in argon have been investigated experimentally and theoretically. In the experiments the pressure was varied from 5×10^{-2} to 1 Torr, the discharge current from 0.2-20 mA, and the discharge tube was 2.6 cm inside diameter. Measurements of the axial electric field, electron density and population in ${}^3P_2$ metastable states are reported for various discharge conditions. A test is made of the usefulness of a two-moment theory which is applicable in the intermediate pressure range of this work, i.e. in the transition from inertia-limited to mobility-limited flow of ions to the wall, for the prediction of the operating characteristics. For this purpose, the electron excitation and ionization rates, and transport parameters were calculated from the homogeneous Boltzmann equation. The predicted similarity laws for the positive column are in reasonable agreement with the measurements only in the lower pressure region, i.e. for a pressure-radius product less than about 0.1 Torr cm. The discrepancy between theory and experiment at the higher pressure is, presumably, the result of the authors' failure to correct the calculated ionization rate and effective electron loss rate for the effects caused by ionization from metastables and by space-charge fields. (70 refs.)

71824 **Evidence for a time dependent excitation process in silane radio frequency glow discharges.** G.de Rosny, E.R.Mosburg,Jr., J.R.Abelson, G.Devaud, R.C.Kerns (Solar Energy Res. Inst., Golden, CO, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2272-5 (May 1983).
A new phenomenon in RF glow discharges has been observed, namely the existence of a strongly time dependent excitation of atomic levels. The observed excitation width of 10 ns (FHWM) is short compared to the 37-ns duration of a half-cycle of the 13.56-MHz applied RF power. This implies a similar time dependence of the density of those electrons responsible for the excitation. Moreover, the excitation propagates through the glow away from the nearer electrode. The nature of this propagation phenomenon is uncertain. These results are deduced from a time resolved study of the $\lambda=288.2$ nm emission from neutral excited silicon, $\mathrm{Si}(4s^1,{}^1P^0)$ and $\lambda=656.3$ nm emission from $\mathrm{H}(n=3)$, generated within the RF silane glow discharge. The radiative lifetimes of these two states are 5.2 and 10 ns, respectively. A study of the Si to H yield ratio, together with some Langmuir probe measurements, indicates that the electrons are thermalized in the glow regions. (11 refs.)

71825 **The ionisation coefficient in Ar-Hg mixtures.** A.L.J.Burgmans, A.H.M.Smeets (Philips Res. Lab., Eindhoven, Netherlands).
J. Phys. D (GB), vol.16, no.5, p.755-62 (14 May 1983).
The ionisation coefficient in Ar-Hg mixtures has been measured for E/n values between 6×10^{-21}V m^2 and 2×10^{-18} V m^2 and for a mercury atom fraction varying from 2×10^{-4} to 2×10^{-2}. The experiments were performed with a parallel-plate apparatus in which the current is measured as a function of the plate separation at constant electric field. The ionisation coefficient was found to be a function of E/n and the mercury atom fraction only. Small admixtures of mercury lead to a large increase in the ionisation coefficient due to Penning ionisation and associative ionisation. From the experimental results the effective rate coefficient for excitation to the appropriate argon states is obtained as a function of E/n, as well as the ratio of the rate coefficients for depopulation of these excited argon states by collisions with argon and mercury atoms respectively. (22 refs.)

71826 **Ionisation and attachment in binary mixtures of SF_6-N_2 and CCl_2F_2-N_2.** M.C.Siddagangappa, C.S.Lakshminarasimha, M.S.Naidu (Dept. of High Voltage Engng., Indian Inst. of Sci., Bangalore, India).
J. Phys. D (GB), vol.16, no.5, p.763-72 (14 May 1983).
Experimental results are presented of ionisation (α) and electron attachment ((η) coefficients evaluated from the steady-state Townsend current growth curves for SF_6N_2 and CCl_2F_2-N_2 mixtures over the range $60\leq E/P\leq240$ (where E is the electric field in V cm^{-1} and P is the pressure in Torr reduced to 20°C). In both the mixtures the attachment coefficients (η_{mix}) evaluated were found to follow the relationship; $\eta_{\mathrm{mix}}=\eta[1-\exp(-\beta F/(100-F))]$ where η is the attachment coefficient of pure electronegative gas, F is the fraction of the electronegative gas in the mixture and β is a constant. The ionisation coefficients (α_{mix}) generally obeyed the relationship $\alpha_{\mathrm{mix}}=\alpha_{N2}(1-F/100)+\alpha_A(F/100)$ where α_{N2} and α_A are the ionisation coefficients of nitrogen and the attaching gas respectively. However, in case of CCl_2F_2-N_2 mixtures, there were maxima in the α_{mix} values for CCl_2F_2 concentrations varying between 10% and 30% at all values of E/P investigated. Effective ionisation coefficients $(\alpha-\eta)/P$ obtained in these binary mixtures show that the critical E/P (corresponding to $(\alpha-\eta)/P=0$) increases with increase in the concentration of the electronegative gas up to 40%. Further increase in the electronegative gas content does not seem to alter the critical E/P. (23 refs.)

71827 **DC nozzle arcs with mild wall ablation.** M.T.C.Fang, D.B.Newland (Dept. of Electrical Engng. & Electronics, Univ. of Liverpool, Liverpool, England).
J. Phys. D (GB), vol.16, no.5, p.793-810 (14 May 1983).
Recent experimental results (Smith et. al., 1980 and Newland et. al., 1982) indicate that nozzle wall ablation can occur even before the arcing current reaches its thermal blocking limit. The wall ablation is caused by intense arc radiation. The evaporated wall material forms an ablation layer which reduces the effective flow area for the arc quenching gas. A theoretical model is established to study the complicated interaction between the ablation layer, the external gas flow and the arc. It has been found that for arcs burning in affinely related nozzles the arc behaviour is controlled by two nondimensional parameters, one of which is similar to the nozzle coefficient (Fang et al, Cowley and Chan). The other nondimensional coefficient, which characterises the effect of wall ablation, is determined by the thermodynamic properties of the nozzle material, the characteristic quantities of the gas and the radiation coefficient for a given upstream electrode material. Three nozzle materials, steel, copper and PTFE, have been studied and two arc quenching gases, SF_6 and air, examined. It has been found that wall ablation greatly reduces the thermal blocking current but only has a marginal effect on the voltage-current characteristics. A comparison with the recent test results (Smith et al, Newland et al) indicates that the theoretical model can adequately describe the nozzle arc behaviour in the presence of wall ablation. (25 refs.)

71828 **Departures from CLTE composition in a nitrogen arc at atmospheric pressure. I. Experimental results.** J.Bacri, M.Lagreca (Centre de Phys. Atomique, Univ. Paul Sabatier, Toulouse, France).
J. Phys. D (GB), vol.16, no.5, p.829-41 (14 May 1983).
The positive column of a wall stabilised arc burning in pure nitrogen at atmospheric pressure is spectroscopically studied. The behavior of local population number densities of atomic and molecular excited levels shows deviations from CLTE composition. These departures are mainly related to diffusion phenomena and radiation escape. (19 refs.)

71829 **Departures from CLTE composition in a nitrogen arc at atmospheric pressure. II. Interpretation of departures from CLTE.** J.Bacri, M.Lagreca (Centre de Phys. Atomique, Univ. Paul Sabatier, Toulouse, France).
J. Phys. D (GB), vol.16, no.5, p.841-54 (14 May 1983).
For pt.I see ibid., vol.16, 829-40 (1983). Departures from chemical equilibrium and from Boltzmann's distribution for excited level populations expected with the assumption of CLTE in a nitrogen plasma at atmospheric pressure are explained by means of a collisional-radiative model taking into account both monatomic and diatomic species, in which transport processes are treated by a parametric approach. (12 refs.)

71830 Lamp model equations taking into account the radial temperature profile of arc plasma. S.Ozaki (Dept. of Electrical Engng., Kobe Tech. Coll., Kobe, Japan), S.Katayama, H.Bo.
J. Illum. Eng. Inst. Jpn. (Japan), vol.67, no.2, p.49-54 (Feb. 1983). In Japanese.
Lamp characteristics are related to the temperature of the arc plasma in high-pressure discharge lamps in which local temperature equilibrium is established. In this paper the relationship between radial temperature profile of the arc plasma measured by optical methods and a mathematical model for lamps is discussed. These discussions can lead to an improvement of the mathematical model after taking into account the temperature profile. The coefficients of the mathematical model equation are determined statistically by using the simplex method. The usefulness of this improved model is discussed, comparing the simulated results with experimental results for discharge lamps operated by resistance ballast. (7 refs.)

71831 Generation and propagation of pressure wave by spark discharge in liquid. H.Tsuchiya, T.Inoue, M.Miyazaki (Kyoto Inst. of Technol., Kyoto, Japan).
Mem. Fac. Ind. Arts Kyoto Tech. Univ. Sci. & Technol. (Japan), vol.31, p.1-13 (Dec. 1982). [received: May 1983]
Deals with energy conversion processes as the basic phenomena in the underliquid electrical discharge forming. Based on the precise observation of electrical and mechanical phenomena, a model is proposed for the process in which the electrical energy released in the electrode gap is converted into the internal energy, the radiation energy of the bubble and energy of the pressure wave in turn. The validity of the model is discussed with regard to both the pressure wave measured by a specially designed device and the electrical energy. It is shown that the pressure level, the size and the possible temperature of the bubble and the form of the pressure wave in liquid can be reasonably evaluated by the model in the case of a shorter electrode gap. In the typical electrode gap, the maximum value of the pressure, that of temperature and that of expansion velocity are 2.8×10^2 MPa, 8.7×10^4K and 160 m/s, respectively. The size of the bubble at the end of the first wave of discharge power is 2.2 mm in radius. The results present the basis for the analytical design of the system of the underliquid electrical discharge forming. (8 refs.)

71832 Ionic space charges generated by evaporating charged liquid sprays. G.S.P.Castle, I.I.Inculet (Univ. of Western Ontario, London, Ontario, Canada), R.Littlewood.
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.59-64
A process is described for collecting fugitive dust emissions which involves the injection of charge into a cloud of particles using a liquid spray. Upon evaporation of the liquid, free ions are produced which quickly adhere to the particles resulting in space charge forces leading to collection on nearby grounded conductors. It is suggested that this process is superior to corona charging for charge injection into a large volume of space. (8 refs.)

71833 Some basic gas and surface discharge phenomena in electrostatics. R.S.Sigmond (Phys. Dept., Norwegian Inst. of Technol., Trondheim, Netherlands), M.Goldman.
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.81-91
In this paper the authors review some recent (and some very old) developments of importance to our understanding of gas and surface phenomena: Unipolar discharges and charge drift in gases. Unipolar charge flow and saturation on insulator surfaces. The initiation of breakdown, and the limitations of Paschen's law, especially in ambient air at μm gap distances: water bridges? Electrochemical effects of Coronas. Streamers and sparks, with some remarks on simulation of long sparks and lightning by sliding discharges on dielectric surfaces. (33 refs.)

71834 Travelling wave coronas as ion source. S.Masuda, H.Nakatani, Y.Shishikui (Dept. of Electrical Engng., Univ. of Tokyo, Tokyo, Japan).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.93-8
Ion density in weakly ionized plasma in negative and positive streamers produced by travelling wave voltage is estimated by experiments. Then, distortion of the voltage wave due to these streamers are measured and discussed. (5 refs.)

71835 Corona charging of immobilized spherical particles. I.I.Inculet, N.Malik, J.A.Young (Faculty of Engng. Sci., Univ. of Western Ontario, London, Ontario, Canada).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.99-104
The experiments described in this paper were prompted by some unusual charging results obtained with gravity falling or gun projected particles in the dark space in the vicinity of corona wires. Tests are reported for the charges acquired by metallic spherical particles at both 100 kPa and 50 kPa pressure, immobilized at various distances from a corona wire in cylindrical geometry. The experimental results corroborate the previously reported anomalies, and raise the question whether a significant bi-ionized region exists in the dark region outside the visible glow. (3 refs.)

71836 The effect of electrode characteristics on the measurement of the minimum ignition energy of dust clouds. D.K.Felstead, R.L.Rogers, D.G.Young (Organic Div., Imperial Chem. Industries plc, Manchester, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.105-10
Dust cloud ignition energies, measured using capacitative sparks, were significantly affected by changes in the electrode separation. The minimum energy required for ignition occurred with electrode gaps of between 11 and 13 mm. It was found that the ignition energy increased with electrode material in the order aluminium alloy$<$lead$<$brass$<$stainless steel and decreased as the electrode diameter was reduced from 35 mm to 3.5 mm; below this diameter measurements were affected by corona discharges. (9 refs.)

Oscillator strengths of neutral and singly ionised molybdenum .... See Entry 70820

On the rotational distribution of N_2 in the Ar-N_2-discharge. The O-O-band of the second positive system .... See Entry 70835

Vibrational kinetics in He-CO reacting discharges .... See Entry 70858

Excitation of vibrational and electronic states in a glow discharge column in flowing N_2 .... See Entry 71002

The ignition of natural gas by spark discharges from the body .... See Entry 71054

Doppler shift and ion mobility measurements of ArH^+ in a He DC glow discharge by infrared laser spectroscopy .... See Entry 71698

Multiply charged plasma-point ions .... See Entry 71707

Breakdown in air near a solid target in a CO_2 laser beam .... See Entry 71757

The interaction of carbon dioxide laser radiation with a pulsed vacuum arc .... See Entry 71761

Temperature measurement of an N_2 glow discharge by emission spectroscopy .... See Entry 71798

Two-dimensional plasma model for the arc-driven rail gun .... See Entry 71804

Interaction of finely dispersed particles with the column of a constricted arc .... See Entry 71806

Kinetics of plasmachemical conversion in a silent electrical discharge .... See Entry 73320

The application of silent electric discharges to propagating flames .... See Entry 73340

60.00 CONDENSED MATTER: STRUCTURE, THERMAL AND MECHANICAL PROPERTIES

61.00 STRUCTURE OF LIQUIDS AND SOLIDS; CRYSTALLOGRAPHY

(see also 68.20 Solid surface structure, 71. Electron states)

The foundations of solid state physics .... See Entry 69850

Advances in the science and technology of crystals .... See Entry 69851

61.10 X-RAY DETERMINATION OF STRUCTURES

(see also 61.80 Radiation damage and other irradiation effects; for specific determinations, see 61.55 to 61.80)

61.10F Experimental techniques

(inc. apparatus, techniques and calculation methods for analyzing experimental results; see also 07.85 X-ray, gamma-ray instruments and techniques)

71837 Criterion for the triaxial X-ray residual stress analysis. T.Hanabusa, K.Nishioka, H.Fujiwara (Faculty of Engng., Tokushima Univ., Tokushima, Japan).
Z. Metallkd. (Germany), vol.74, no.5, p.307-13 (May 1983).
In X-ray analysis of periodically distributed short range microscopic residual stresses triaxial stress states have been investigated. The relaxation of the components of residual stresses in spherical inclusions near the surface layer was analysed in order to estimate the weighted-averaged strain. The experimental data measured for silicon particles in a Al-Si alloy as well as the M_6C carbide particles in a highspeed steel were compared with the analytical ones. It was confirmed that the triaxiality has to be considered in X-ray stress measurements if the wave length of the microscopic residual stresses is smaller than the penetration depth of the X-ray used. (14 refs.)

The new potential of powder diffraction. Structure determination and refinement using profile analysis technique .... See Entry 71838

Crystal structures of several silicon carbide polytypes belonging to a special structure family .... See Entry 71933

61.12 NEUTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

71838 The new potential of powder diffraction. Structure determination and refinement using profile analysis technique. H.Manohar (Dept. of Inorganic & Phys. Chem., Indian Inst. of Sci., Bangalore, India).
Curr. Sci. (India), vol.52, no.2, p.39-44 (20 Jan. 1983).
Recent years have witnessed a spectacular revival of interest in powder diffraction. High intensity sources of X-ray and neutrons and improvements in instrumentation have made it possible to collect accurate data in very short times. As a result of advances in computer technology and software development, more data can be processed in a given time; on-line search match can be carried out for the identification of unknown phases. Important advances have also occurred in the indexing of powder patterns and accurate determination of cell parameters. A major development has been the application of the Rietveld profile analysis technique, initially to neutron data and subsequently to X-ray data, as a result of which the number of structure refinements is steadily increasing. The author describes the Rietveld approach and its recent extension to the elucidation of unknown structures in combination and conventional Fourier methods. The significance of this new development in chemistry and materials science is highlighted. (27 refs.)

71839 Neutron scattering equation for chemical short-range order in binary non-crystalline alloy. H.Ruppersberg (Fachbereich Angewandte Phys., Univ. des Saarlandes, Saarbrucken, Germany), C.N.J.Wagner.
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.165-8 (April 1983).
Recently Sakata et al. (1981) proposed a modification of the Bhatia-Thornton equation (1970) for the case of neutron scattering if the elements of the binary alloy under investigation consist of isotopic mixtures. The contributions of the different partial structure factors and of incoherent scattering to the total scattering became clearly changed. The authors show that the original Bhatia-Thornton equation has to be applied without any modifications. (10 refs.)

61.14 ELECTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

61.14F Experimental diffraction and scattering

Determination of grain boundary rotation parameters from Kikuchi patterns. II. Experimental optimization of the analysis of grain boundary orientation relationships and verification of the accuracy of the proposed method ....See Entry 71975

61.14H Low-energy electron diffraction (LEED) and reflection High-energy electron diffraction (RHEED)

71840 Fine-structure analysis of spin-polarized low-energy electron diffraction from W(001). R.O.Jones (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), P.J.Jennings.
Phys. Rev. B (USA), vol.27, no.8, p.4702-11 (15 April 1983).
The theory of spin-polarized low-energy electron diffraction (LEED) is used to analyze the observed fine structure in experimental data for W(001). Within a spin-dependent scattering model, a saturated image barrier provides a satisfactory description, and the analysis leads to a model of the surface potential barrier for W(001). Simpler models, such as those commonly used for LEED intensity calculations, are unable to reproduce all of the observed structure. The complex fine structure of the spin-polarized LEED intensity curves as interpreted in terms of the interaction between Bragg peaks, spin-dependent features, and barrier scattering effects. Resonance effects do not need to be involved. (31 refs.)

71841 Dynamical effects of the surface potential barrier in very low energy electron diffraction. J.Lopez (Univ. of Claude Bernard, Villeurbanne, France), J.C.Le Bosse, C.Gaubert, R.Baudoing, Y.Gauthier.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.286-93 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
On the basis of algebraical results examplified with exact computations, the authors investigate the dynamical effects associated with the presence of the surface potential barrier in very low energy electron diffraction (VLEED). These effects essentially have three origins: (i) the diverging phase of the reflection amplitude from metal back to metal leads to rapid oscillations of intensity located below emergence thresholds, the maxima of which are arranged in a Rydberg-like series. This effect, wrongly attributed to a resonance process, is actually due to a simple interference mechanism (ii) The singularity near zero of the transmission amplitude of the barrier from metal to vacuum leads to a discontinuity in the current of non-specular beams at their emergence threshold. (iii) The interference between the waves directly reflected at the surface barrier and at the atomic planes generally induces large modifications of the intensity profiles spreading out on the whole VLEED energy range. Thus the approximation consisting in neglecting the reflection at the surface barrier is inadequate. (14 refs.)

61.16 OTHER DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

61.16D Electron microscopy determinations

71842 The specimen thickness effect upon the electron microscope image contrast transfer of amorphous objects. P.Bonhomme, A.Beorchia (Lab. de Microscopie Electronique, Reims, France).
J. Phys. D (GB), vol.16, no.5, p.705-13 (14 May 1983).
From experimental measurement the authors show that amorphous carbon specimens imaged by 100 keV conventional transmission electron microscopy (CTEM), with thicknesses as large as 100 nm behave like weak phase objects. The defocus of the phase transfer contrast function cannot be evaluated from the exit surface plane of the object but may be from its middle plane. A theoretical model explaining these results is propounded. (13 refs.)

71843 Problems of interpretation in high resolution electron microscopy. A.Howie (Cavendish Lab., Cambridge Univ., Cambridge, England).
J. Microsc. (GB), vol.129, pt.3, p.239-51 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
Current assumptions in wave aberration theory and specimen scattering theory are reviewed. More quantitative image simulations would be valuable as well as use of a wider range of imaging techniques, particularly STEM. The severe difficulties of high resolution three-dimensional reconstruction are described and illustrated. (39 refs.)

71844 The STEM approach to the imaging of surfaces and small particles. J.M.Cowley (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA).
J. Microsc. (GB), vol.129, pt.3, p.253-61 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
The characteristics of scanning transmission electron microscopy, which makes it amenable to recording and image processing procedures, the possibility of correlating the image data with microdiffraction patterns and microanalysis of chosen small regions and the possibilities for combining several different image signals obtained simultaneously. Images obtained from surfaces using reflected diffraction beams may be very sensitive to variations of surface structure but the resolution, depth of focus and contrast of the images are strongly dependent on the nature of the surface and the aperture sizes used in the microscope. Microdiffraction patterns may be obtained from small surface features. Electron energy loss analyses of the diffracted beams provides sensitive indications on surface electron excitations. Microdiffraction patterns obtained in transmission from regions of 1-5 nm diameter provide valuable information on the structure and defects of small crystals, such as those of platinum and gold which are of interest in relation to the study of catalysts. (17 refs.)

71845 The use of moire techniques to measure rigid body displacements. R.C.Ecob, W.M.Stobbs (Dept. of Metall. & Materials Sci., Cambridge Univ., Cambridge, England).
J. Microsc. (GB), vol.129, pt.3, p.275-84 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
The relative advantages and disadvantages of a variety of experimental electron microscopical techniques for the measurement of rigid body displacements are considered. The principles of the application of a moire method of great simplicity and high potential accuracy are then further discussed as are the experimental difficulties associated with the superposition of suitable reference lattices on a substrate. The method is then applied to obtain an upper limit for the rigid body displacement at {111} $\Sigma 3$ twin boundaries in stainless steel. (13 refs.)

71846 Coherency strain fields: magnitude and symmetry. A.J.Porter, R.C.Ecob, R.A.Ricks (Dept. of Metall. & Materials Sci., Cambridge Univ., Cambridge, England).
J. Microsc. (GB), vol.129, pt.3, p.327-36 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
Considers the various methods available for the measurement of small values of in-situ lattice misfit between a coherent particle and the matrix. Examination of such misfits by Asby-Brown contrast imaging, moire fringe measurements, lattice fringe imaging and convergent beam electron diffraction (CBED) is considered, and the results obtained by these techniques are compared. In addition, the nature of the strain fields in the matrix adjacent to a coherent misfitting particle is examined using CBED. (15 refs.)

71847 Techniques for investigating structure and composition with high spatial resolution. J.B.Vander Sande (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.153-60
The techniques of scanning transmission electron microscopy and atom probe field ion microscopy are briefly described. The advantages of these techniques for high spatial resolution compositional analysis are discussed and examples cited. (4 refs.)

MICRO 82: High Resolution Electron Microscopy .... See Entry 69778

Tunneling current microscopy ....See Entry 70151

Are the core structures of dislocations and grain boundaries resolvable by HREM? ....See Entry 71965

An investigation of order/disorder in a chromia-doped rutile by high-resolution electron microscopy .... See Entry 71980

On EBIC versus time measurements in thin semiconductor layers with the scanning electron microscope .... See Entry 72412

Electron beam-solid interactions: implications for high spatial resolution Auger electron spectroscopy ....See Entry 72897

61.16F Field-ion microscopy determinations

Techniques for investigating structure and composition with high spatial resolution ....See Entry 71847

61.16N EPR and NMR determinations

Distribution of Cl^- and Br^- ions in mixed crystals $(CH_3NH_3)_2Cu(Cl_{1-x}Br_x)_4$ .. ..See Entry 72683

61.20 CLASSICAL, SEMICLASSICAL, AND QUANTUM THEORIES OF LIQUID STRUCTURE

(for kinetic and transport theory, see 51.10; for electronic states, see 71.; for liquid helium, see 67.)

71848 Molecular properties in liquid phase. L.M.Sese (Univ. Nacional de Educacion a Distancia, Madrid, Spain), M.Fernandez.
THEOCHEM (Netherlands), vol.10, p.261-4 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
A model for studying environmental effects on the molecular properties is proposed. Basic concepts of statistical mechanics and quantum chemistry are linked in a natural way in the theory. Liquids are considered composed by molecules whose electronic wavefunctions are not the same as those in the isolated molecules. The electronic wavefunction for the diluted molecule can be obtained from any molecular orbital formalism, introducing appropriate corrections in the monoelectronic hamiltonian to account for molecular interactions. To determine the magnitude of these corrections, statistical mechanics atom-atom distribution functions of the considered liquid are used. The perturbation method is used to obtain molecular orbitals of the molecule in the liquid, from molecular orbitals of the isolated molecule. In order to study the practical features of the proposed model, the authors have applied it to carbon disulphide in the liquid phase for three different densities. The radial distribution functions at 282.16K has been obtained by using the Monte-Carlo method. The molecular orbitals have been calculated by means of the CNDO/2 method. (3 refs.)

71849 Binary theory of dephasing in liquid solutions. I. The non-Markovian theory of encounters. A.A.Kipriyanov, A.B.Doktorov, A.I.Burshtein (Inst. of Chem. Kinetics & Combustion, Novosibirsk, USSR).
Chem. Phys. (Netherlands), vol.76, no.2, p.149-62 (15 April 1983).
A non-Markovian version of encounter theory is proposed which consistently takes into account fast dissipative processes. Kinetic equations of vibrational molecular states dephasing at binary encounters in solutions are derived in terms of this theory. A particular case of fast molecular rotation is considered. The characteristic impurity dephasing time is calculated for the case of weak molecular interactions. (44 refs.)

71850 Binary theory of dephasing in liquid solutions. II. Motion-transformed isotropic Raman spectra. A.A.Kipriyanov, A.B.Doktorov, A.I.Burshtein (Inst. of Chem. Kinetics & Combustion, Novosibirsk, USSR).
Chem. Phys. (Netherlands), vol.76, no.2, p.163-74 (15 April 1983).
For pt.I see ibid., vol.76, no.2, p.149 (1983). The non-Markovian theory of encounters is applied to calculations of impurity dephasing kinetics, corresponding Raman spectra and their moments. The theory is checked against the model of suddenly switched interactions and then applied to linewidth calculations under dynamic and stochastic dephasing. The former occurs for isotropic short-or long-range interactions. The latter takes place in the case of anisotropic dipole-dipole interactions modulated by fast rotation. Within perturbation theory the line is stated to be motion-narrowed in the former case and independent of translational motion in the latter case. If the interaction is strong, the line is motion-broadened in both cases but in different ways depending on whether the interaction was switched on by a jump or by continual diffusion. Perturbation theory becomes inapplicable to impurity dephasing much earlier than is conventionally assumed. (39 refs.)

71851 The shape of the Lorentz cavity and the internal field in anisotropic fluids. D.A.Dunmur (Dept. of Chem., Univ. of Sheffield, Sheffield, England), R.W.Munn.
Chem. Phys. (Netherlands), vol.76, no.2, p.249-53 (15 April 1983).
The predictions of the ellipsoidal Lorentz cavity model for different cavity axial ratios are compared with the predictions of a microscopic molecular

crystal model for different molecular axial ratios. The models agree when the cavity depolarisation factor equals the crystal Lorentz factor. Numerical calculations show that the axial ratio of the cavity equivalent to the molecule is roughly equal to the molecular axial ratio up to ≈ 5, but increases rapidly thereafter. For molecular axial ratios of 9 and above there is no equivalent cavity. Implications of the results for the internal field in liquid crystals are considered. (28 refs.)

71852 Law of corresponding states of uni-univalent molten salts. M.Harada, M.Tanigaki (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan), Y.Tada.
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.1, p.116-21 (Feb. 1983).
A method to yield a law of corresponding states for alkali halides was developed. The complicated pair potential between the constituting ions was simplified to Coulomb and soft-core potentials. The state functions of real molten salts were mapped to the domain of the reference salt, whose ions interact through the hard-sphere core potential and the Coulomb potential by scaling the soft-core potential. The validity of the mapping was demonstrated for potassium chloride by use of the computer simulation of L.V. Woodcock et al. (1971). The corresponding-states correlation for the thermodynamic properties of alkali halides was obtained in the mapped space. A simplified corresponding-states correlation using the characteristic temperature and the molar volume was also discussed. (18 refs.)

71853 A van der Waals model of chiral mixtures using a chiral Lennard-Jones potential. Applications to the Pasteur experiment and phenomena in chiral solvents. P.E.Schipper, P.R.Harrowell (Dept. of Theoretical Chem., Univ. of Sydney, Sydney, NSW, Australia).
J. Am. Chem. Soc. (USA), vol.105, no.4, p.723-30 (23 Feb. 1983).
Much of the understanding of the behavior of simple fluids stems from the combination of a simple Lennard-Jones potential and a subsequent van der Waals approach to the statistical thermodynamics of such fluids. In this paper, both are generalized to incorporate the effects of chirality as a basis for the discussion of the properties of chiral mixtures at the simplest level. In this way, the role of chirality in leading to characteristic thermodynamic effects may be rigorously defined. Although the model may be too simple to apply quantitatively in that chiral mixtures are frequently relatively complex in structure, it serves as a natural starting point for understanding and defining the role of chirality in thermodynamic phenomena in the solution phase. The model is applied to a number of solution phenomena, such as the possible role of solution configurations in spontaneous resolutions (the Pasteur experiment), and equilibrium shifts of labile racemates or differential enantiomeric solubilities in chiral solvents. (30 refs.)

71854 Computer simulation of liquid anisotropy. IV. Terms to second order in the external field of force. M.W.Evans (Chem. Dept., Univ. Coll. of Wales, Aberystwyth, Wales).
J. Chem. Phys. (USA), vol.78, no.9, p.5403-7 (1 May 1983).
The method of molecular dynamics computer simulation is extended to deal with liquid anisotropy induced by the interaction of an external electric (or magnetic) field with anisotropy of polarizability. The resulting Langevin functions follow accurately the analytical results of Kielich (1970). The new method is applied to extract the details of rotation/translation interaction in a moving frame of reference. The appropriate first order correlation functions are much more oscillatory in the presence of a strong external field. (29 refs.)

71855 Evaluation of the SSC/LHNC, SSCF and PY approximations for short ranged, anisotropic potentials. P.T.Cummings (Depts. of Mech. Engng. & Chem., State Univ. of New York, Stony Brook, NY, USA), J.Ram, R.Barker, C.G.Gray, M.S.Wertheim.
Mol. Phys. (GB), vol.48, no.6, p.1177-207 (20 April 1983).
Three approximations for the orientational correlation function of molecular fluids (the single superchain/linearized hypernetted chain (SSC/LHNC), single superchain f-expansion (SSCF) and Percus-Yevick (PY) approximation) are evaluated in the dense liquid state for a fluid interacting with short ranged anisotropic interactions. These interactions are prototypical of the forces that determine the nonspherical shape of symmetric linear molecules. The authors find that SSC/LHNC is very poor, failing to predict many of the structural features present in the Monte Carlo (MC) simulation results. The PY and SSCF approximations produce much better results; however, neither approximation is completely satisfactory. (27 refs.)

71856 Nonpolar solute-water pair correlation functions—a comparison between computer simulation and theoretical results. A.Tani (Istituto di Chimica Fisica, Univ. di Pisa, Pisa, Italy).
Mol. Phys. (GB), vol.48, no.6, p.1229-40 (20 April 1983).
The microscopic theory of the solvation of nonpolar solutes in water proposed by Pratt and Chandler (1977) has been generalized in order to obtain separate solute-oxygen and solute-hydrogen radial distribution functions, $g(r)$. The $g(r)$s predicted by this method for a spherical solute have been tested by comparison with the corresponding functions from two computer simulation studies. The water-water interactions were described by the configuration interreaction potential (CI) in both cases. The agreement between theoretical and simulation results is good for the solute-oxygen $g(r)$, less so for the solute-hydrogen function. Moreover, the influence of the model of water on the calculated solute-solvent $g(r)$s has been examined by comparing results obtained with partial structure functions derived from the CI model and from recent neutron diffraction measurements. It is found that CI model and real water yield remarkably different solute-water radial distribution functions. Finally, the solvation of a model two-site solute has been studied for various bond lengths and the results confirm that when the space between the sites is sufficient to host a water molecule, the solvation of each site is the same as that of an isolated site, with respect to oxygen as well as hydrogen. (26 refs.)

71857 Equilibrium properties of a 2-2 electrolyte model—Monte Carlo and integral equation results for the restricted primitive model. S.A.Rogde (Dept. of Chem., Univ. of Bergen, Bergen, Norway), B.Hafskjold.
Mol. Phys. (GB), vol.48, no.6, p.1241-53 (20 April 1983).
Thermodynamic and structural results are reported for the restricted primitive model (RPM) in the 2-2 aqueous electrolyte regime. The regime corresponds to salt concentrations from 0.0001 M to 3 M, at 25°C. The Monte Carlo method, the HNC approximation and a PY-like integral equation were used in order to examine the model system. Good agreement is found between the various methods, except at the intermediate concentrations, where the HNC overestimates the amount of triple-ion aggregates ($+-+$ and $-+-$). (27 refs.)

71858 Dielectric friction on a polar molecule rotating in a fluid. B.U.Felderhof (Inst. fur Theoretische Phys., RWTH Aachen, Aachen, Germany).
Mol. Phys. (GB), vol.48, no.6, p.1269-81 (20 April 1983).
The author considers the continuum model for dielectric friction on a polar molecule rotating in a fluid. Taking account of electrohydrodynamic coupling he calculates the frequency dependent rotatory friction coefficient to second order in the strength of the permanent dipole moment. (14 refs.)

71859 Dielectric friction on an ion rotating in a fluid. B.U.Felderhof (Inst. fur Theoretische Phys., RWTH Aachen, Aachen, Germany).
Mol. Phys. (GB), vol.48, no.6, p.1283-8 (20 April 1983).
The author considers the continuum model for dielectric friction on an ion rotating in a polar fluid. Taking account of electrohydrodynamic coupling he evaluates the frequency dependent rotatory friction coefficient for arbitrary values of the charge. (12 refs.)

71860 Thermodynamical behaviour and radial distribution functions of dilute systems of charged rigid spheres. S.Ciccariello (Istituto di Fisica 'G. Galilei', Padova, Italy), D.Gazzillo.
Mol. Phys. (GB), vol.48, no.6, p.1369-81 (20 April 1983).
The excess thermodynamical functions and the radial distribution functions for dilute systems of charged rigid spheres with different radii and/or electrical valences have been evaluated by two different methods. One consists in taking into account the first order perturbative correction in the Meeron renormalized cluster expansion. The other one leans upon a simple variational optimization procedure. The results are compared with available hypernetted chain and Monte Carlo results. (15 refs.)

71861 Microscopic mechanism of the cage effect in simple liquids. Y.Endo (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan), H.Endo.
Phys. Lett. A (Netherlands), vol.95A, no.2, p.92-4 (18 April 1983).
Atomic motions in a soft-core liquid are classified by molecular dynamics simulation into subgroups which are characterized by the number of atoms surrounding a central atom. It is found that the rigidity and lifetime of the microstructure of the cage depend on the local environment around the central atom. (7 refs.)

71862 Computer simulation of the phases of two-dimensional Lennard-Jonesium: evidence for first-order transitions. F.F.Abraham (IBM Res. Lab., San Jose, CA, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.75-95
An extensive computer simulation investigation of the structure, thermodynamics and phase stability of the two-dimensional Lennard-Jones system is presented, with special emphasis on the low-pressure melting regime of the phase diagram. This investigation includes isobaric-isothermal Monte Carlo and molecular dynamics simulations of the various phases of the two-dimensional Lennard-Jones system and of the melting and vaporization processes, isodensity-isothermal Monte Carlo simulations of two-phase coexistence between crystal and liquid, the determination of the phase diagram, the establishment of the thermodynamic melting temperature, and the determination of the physical significance of the Kosterlitz-Thouless-Feynman dislocation model for melting in relation to the stability of the crystalline phase. The author concludes that the phase diagram of the Lennard-Jones system in two dimensions is qualitatively similar to that in three dimensions. (58 refs.)

The pressure tensor at the planar surface of a liquid ....See Entry 72183

61.25 STUDIES OF SPECIFIC LIQUID STRUCTURES

(see also 61.40 Amorphous and polymeric materials)

71863 Cooperative behaviour in liquids. G.J.Evans (Edward Davies Chem. Labs., Univ. Coll. of Wales, Aberystwyth, Wales).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.547-58 (April 1983).
Evidence is presented for the existence of strong cooperative behaviour in the liquid state. It is suggested that the far-infrared spectrum of CH_3CN is composite in nature and that only a small portion may be attributed to the so-called 'Poley absorption' supposedly characteristic of polar liquids in the far-infrared. This is in accord with a recent conclusion of other authors in a quite independent investigation. There is strong evidence from a number of spectroscopic methods that a strong local order exists in acetonitrile that persists in solutions down to 10% and less. The consequence of this association is that absorptions other than those arising from single-particle motions (which peak at ca. 60 cm^{-1}) contribute to the total profile which has a maximum absorption of ca. 100 cm^{-1}. Detail is resolved on the low-frequency side of the far-infrared spectral profile that has not been reported previously. In particular, a strong feature at the frequency of maximum absorption, clearly resolved with an interferometric system, appears to be confirmed with a line from a tunable laser system. At this stage it is only possible to speculate on the origin of this detail but there is significant evidence available that suggests a contribution to the profile from the motions of aggregates of molecules. A whole set of intermolecular vibrational transitions is then possible and they may strongly overlap each other. The author presents other new observations that also seem to reflect strong cooperative behaviour in the liquid state. (23 refs.)

71864 Multidetector scattering as a probe of local structure in disordered phases. N.A.Clark (Dept. of Phys., Univ. of Colorado, Boulder, Co, USA), B.J.Ackerson, A.J.Hurd.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1459-62 (9 May 1983).
The local translational structure of a two-dimensional colloidal liquid is observed by use of cross correlation of the intensity fluctuations of light scattered by the liquid through two different wave vectors. The utility of multidetector scattering in probing multipoint correlations in disordered phases is thereby demonstrated unambiguously. (9 refs.)

Artefact peaks in particle size distributions measured by the electrical sensing zone (Coulter counter) method ....See Entry 70033

Molecular properties in liquid phase ....See Entry 71848

Law of corresponding states of uni-univalent molten salts ....See Entry 71852

Evaluation of the SSC/LHNC, SSCF and PY approximations for short ranged, anisotropic potentials ....See Entry 71855

Nonpolar solute-water pair correlation functions—a comparison between computer simulation and theoretical results .... See Entry 71856

Rigid backbone polymers: thermal behavior of polyhexylisocyanate mesomorphic solutions ....See Entry 71867

Phase transition in a solution of heteropolymers .... See Entry 72096

Small-angle neutron scattering from an oil-in-water microemulsion as a function of temperature .... See Entry 73372

The friction coefficient in deswelling gels ....See Entry 73373

61.25M Liquid metals

71865 Relation between the chemical short-range order in liquid and amorphous alloys. C.N.J.Wagner, H.Ruppersberg (Dept. of Materials Sci. & Engng., Univ. of California, Los Angeles, CA, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.91-102
Recent advances in both diffraction theory and experiment have led to the determination of the topological and chemical short-range order in liquid alloys and metallic glasses. In binary alloys, three partial interference functions (or partial structure factors) must be determined to evaluate the Warren chemical short-range order parameter α. Examples of recent attempts to determine α in binary liquid and glass alloys are given. In most glasses studied so far evidence exists for the occurrence of unlike nearest neighbor ordering which must be present in the liquid state. (27 refs.)

61.30 LIQUID CRYSTALS

(see also 64.70M Transitions in liquid crystals)

71866 Mesomorphic properties of some nitro substituted azomethines. V.Reiffenrath, F.Schneider, N.K.Sharma (Physikalische Chem., Univ. Siegen, Siegen, Germany).
Indian J. Chem. A, vol.21A, no.9, p.869-72 (Sept. 1982). [received: May 1983]
The homologous series of 4′-*n*-alkoxybenzylidene-4-nitroanilines (I) and 4″-*n*-alkoxybenzylidene-4′-amino-4-nitrobiphenyls (II) have been synthesized and their mesomorphic properties investigated. Generally, the alkoxybenzylidene-nitroanilines show only monotropic nematic and smectic phases, whereas the biphenyl derivatives exhibit broad nematic and smectic phases. The smectic phases of the biphenyl compounds are of the S_B and S_E types which are scarcely observed for liquid crystals with polar terminal groups. X-ray studies show that the smectic phases of both the series exhibit bilayer structures. (13 refs.)

71867 Rigid backbone polymers: thermal behavior of polyhexylisocyanate mesomorphic solutions. P.Navard, J.M.Haudin (Ecole Nat. Superieure des Mines de Paris, Paris, France), S.M.Aharoni.
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.4, p.271-5 (April 1983).
Many polyisocyanates are able to form lyotropic solutions when mixed with numerous solvents. One of the most important results in the comparison between experimental data and the theory developed by Flory et al. (1978). All the main features of this theory were verified, i.e. the occurrence of a biphasic interval, the qualitative agreement of the phase diagrams, and the partitioning between isotropic and anisotropic phases. The thermal behavior of polyhexylisocyanate (PHIC)-toluene solutions is investigated. (23 refs.)

71868 Diffusion and orientability of rigid-rod molecules. J.A.Odell, E.D.T.Atkins, A.Keller (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.4, p.289-300 (April 1983).
Thermally stable aromatic polymers possessing a high degree of chain linearity and stiffness form liquid-crystal-like solutions in strong acid solvents. The polymers are processed from the nematic state in fibers and films of exceptional stiffness and strength. A knowledge of the response of such systems to orientational flow fields and of subsequent relaxation processes is central to the processing of such polymers and is of considerable theoretical interest. An important recent theory by Doi (1975) and Doi and Edwards (1978) provides the basis of understanding the behavior of strongly interacting systems of rigid rods, at least at moderate concentration. Methods have been developed to enable the study of the response of flexible and semiflexible polymer chains to well-defined extensional flow fields. One such method is the four-roll mill providing a pure-shear extensional flow field over a rigid molecule to such flow fields. The results provide a method for the assessment of orientability, expressed in terms of rotational diffusion coefficient, as a function of strain rate (orientation) and concentration for solutions which are isotropic at rest. The existing theories account qualitatively for many of the observed effects, but quantitative agreement is poor. The theoretical basis is critically reexamined, and modifications are presented which can bring experimental results and theory quite closely to agreement. Even so, it seems that in wider generality a new and different basic approach needs to be taken. (15 refs.)

71869 The circular dichroism of cholesteric cellulose acetate solutions; dependence on molecular weight. P.Sixou, J.Lematre, A.T.Bosch, J.M.Gilli, S.Dayan (Lab. de Phys. de la Matiere Condensee, Univ. de Nice, Nice, France).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.277-83 (1983).
Concentrated solutions of cellulose acetate in trifluoroacetic acid are cholesteric liquid crystals. The circular dichroism of solutions of two samples of cellulose acetate of different molecular weights has been examined. Under the same conditions of temperature and polymer concentration by weights the solutions of the higher molecular weight polymer gave circular dichroism peaks at higher wavelength and of higher intensity and are therefore presumably more highly ordered. Solutions containing mixtures of polymer chains of two different lengths gave a single circular dichroism peak which occurred at a wavelength intermediate between those corresponding to the two polymer species. The intensity of the peak was, however, considerably reduced, in some instances being lower than that which would have been given by either component taken on its own. (19 refs.)

71870 Pretransitional behavior of 8-12 CB. Zhang Shu-Lin, Peng Zheng-Yu, Wu Jin, Shen Tie-Han, Wu Nai-Qiang (Dept. of Phys., Peking Univ., Beijing, China).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.295-307 (1983).
The magnetic birefringence in the isotropic phase vs. temperature for the liquid crystal alkyl cyanobiphenyls (C_nH_{2n+1}-biphenyl-CN), n=8-12, has been measured. The inverse of the Cotton-Mouton coefficient values, R, vs. temperature T were plotted. The shape and the influence of the smectic phase on the 'bending down' in the R vs. T curve near the clearing point T_c are discussed. The so-called 'odd-even effect' is observed. In the experiments on 9 CB and 11 CB, the 'inflection' or 'saturation' in the 'bending down' region mentioned in the work of Coles and Strazielle, and Pouligny et al., respectively, are not observed. (18 refs.)

71871 The influence of an external electric field on the structure of chiral Sm C* liquid crystal. M.Glogarova, L.Lejcek, J.Pavel, V.Janovec, J.Fousek (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.309-25 (1983).
The mechanism of a field induced transition from the helical Sm C* to Sm C structure in a DOBAMBC liquid crystal situated between two glass plates has been studied by optical methods. The important role of a regular system of twist disclination lines (dechiralization lines) in unwinding the helical structure by an electric field has been revealed. A simplified model of $\pm 2\pi$ twist disclination pairs is proposed which describes the unwinding of the Sm C* structure. Under the external electric field the pairs of $\pm 2\pi$ twist disclinations move and annihilate each other and thus effectively unwind the helical structure of the sample. Critical fields for switching the helical Sm C* structure, as well as the unwound structure, are estimated. (28 refs.)

71872 Order parameters for isomeric phenyl substituted anthraquinone dyes dissolved in nematic liquid crystals mixtures—influence of the host. J.Cognard, T.Hieu Phan, N.Basturk (ASULAB SA, Neuchatel, Switzerland).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.327-40 (1983).
Substitution of the anthraquinone ring system has provided dyes suitable for guest-host applications. In general, one seeks to elongate the anthraquinonic system through a fourth ring. Different molecular structures have been proposed which all have similar ordering in the liquid crystalline host. Surprisingly, the 2-*p*-alkoxyphenyl substituted 1,5-dihydroxy-4,8-diaminoanthraquinones have a higher order parameter in liquid crystalline mixtures of positive dielectric anisotropy made from cyano substituted molecules. They lose this property in a system consisting of molecules without cyano groups at the termini of the molecular axes. The properties of two isomeric substituted anthraquinone dyes in different hosts are compared in order to illustrate the considerable influence that dye-liquid crystal interactions may have on the dye order parameter. (10 refs.)

71873 Cyano mesogens: a new interpretation of the structure of the bilayer smectic A phase. D.Guillon, A.Skoulios (Centre de Recherches sur les Macromolecules, Strasbourg, France).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.341-52 (1983).
A new model describing the bilayer structure of the smectic A mesophases observed with cyano mesogens is proposed. The authors' interpretation is based upon recent experimental X-ray studies of binary mixtures containing a cyano mesogen on one hand and a non-polar one on the other, with either one or two aliphatic chains in the molecules. In this model, the smectic layers are formed of the intimate mixture of single molecules and of dimers described as being pairs of molecules associated head-to-head. As a result, the degree of dimerization is far from unity due to the steric hindrance of the aliphatic chains; it decreases notably when the average number of aliphatic chains in the system increases. (12 refs.)

71874 Light scattering from nematic liquid crystals in a nonuniform velocity field. E.A.Jacobsen, J.B.Swift (Dept. of Phys., Univ. of Texas, Austin, TX, USA).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.353-7 (1983).
Fluctuations about a nonequilibrium steady state of a nematic liquid crystal subject to small, linear shear, are studied by means of a generalized Langevin method. The authors find a symmetric broadening of the director power spectrum and estimate the numerical size of the effect of a typical material. (8 refs.)

71875 Reexamination of the theory and experimental results of optically induced molecular reorientation and nonlinear diffractions in nematic liquid crystals: spatial frequency and temperature dependence. I.C.Khoo (Dept. of Phys. & Astron., Wayne State Univ., Detroit, MI, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2747-50 (May 1983).
Presents a detailed calculation of, and experimental results on, the dependence of degenerate four-wave mixing and nonlinear diffraction in a nematic film on the spatial frequency of the intensity grating generated by two overlapping lasers. The explicit analytical expressions allow a critical reexamination of previous results and lead to better agreement between theory and experiments. Some of the previous theoretical and experimental results are reconfirmed. The author also presents further detailed results on the temperature dependence of nonlinear diffraction. (9 refs.)

71876 Absorption edge of liquid crystal TBBA and the effect of an electric field on the spectra. T.P.Myasnikova, G.N.Zhizhin, N.I.Afanas'eva (Inst. of Spectroscopy, Acad. of Sci., USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1770-2 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3128-30 (Oct. 1982). [received: April 1983]
Terephthal-bis-butylaniline (TBBA), which has five liquid-crystal phases, is among the most studied of liquid crystals. The authors report a study undertaken to investigate the changes in the edge region of the absorption spectra during the phase transitions, to elucidate the role of exciton-phonon interactions, and to determine the effect of an alternating electric field on the position of the edge. (7 refs.)

71877 Dependences of the parameters of the liquid-crystal order on the molecular hyperpolarizability. G.A.Lyakhov, Yu.P.Svirko, I.M.Fedotova (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1525-6 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2341-3 (Nov. 1982). [received: May 1983]
An anharmonic oscillator model of an anisotropic molecule is used to calculate the changes in the temperature of a nematic phase transition and in the pitch of a cholesteric helix as a function of the cubic hyperpolarizability. The results obtained are used to explain the nonmesogenic nature of anisotropic molecules with an internal (intramolecular) charge transfer. (7 refs.)

71878 An analysis of small-angle X-ray scattering by smectic polymers. Yu.S.Lipatov, V.V.Tsukruk, V.V.Shilov.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.543-9 (April 1983). In Russian.
Small-angle X-ray scattering has been used to study some polymers with side mesogenic groups. One-dimensional correlation functions are obtained by the Fourier transformations of intensity data. The electron density distribution in the layers can be represented as a two-step function with a higher hard nuclei packing density of the mesogenic groups. A model is suggested to represent the polymer microstructure as 20-55 nm 'layer packets' inside which there exists a positional correlation of the layer arrangement. (23 refs.)

Configurations in crystals, rod lattices, and lamellar systems . See Entry 71918

Temperature dependence and asymmetry of the hypersound velocity in cyanobiphenyl liquid crystals .... See Entry 72050

I-N-A phase diagrams of liquid crystals .... See Entry 72105

Reentrant behavior and cyano substituted aryl p-alkoxycinnamates .... See Entry 72106

Calorimetric study of the smectic-*A*-smectic-*C* phase transition in liquid crystals .... See Entry 72107

Heat-capacity study of phase transitions in the liquid-crystal racemic 4-(2′-methylbutyl)phenyl-4′-*n*-nonyloxybiphenyl-4-carboxylate (2M4P9OBC) .... See Entry 72108

X-ray study of the smectic A-nematic phase transition in 4-n-pentylphenyl-4-(trans-4′-n-pentylcyclohexyl) benzoate .... See Entry 72109

Optics of the blue phase of cholesteric liquid crystals .... See Entry 72758

61.40 AMORPHOUS AND POLYMERIC MATERIALS

(see also 64.70P Glass transitions 81.20P to 81.20T, and 81.60 Materials science)

71879 Crystallization of Fe-P amorphous alloys as studied by the EDXD method. E.Hiltunen (Dept. of Phys. Sci., Univ. of Turku, Turku, Finland), L.Takacs.
J. Mater. Sci. (GB), vol.18, no.5, p.1515-21 (May 1983).
The crystallization of amorphous Fe-P alloys, made by electrodeposition were studied using energy dispersive X-ray diffraction (EDXD), thermomagnetic, and Mossbauer measurements. EDXD proved to be especially useful, because its very short exposure time enabled the authors to perform isothermal crystallization measurements with practically continuous control by means of diffraction spectra. By measuring the intensity of the appropriate diffraction lines, the crystallization kinetics of each phase could be recorded simultaneously. At 610K the crystallization of an $Fe_{81.2}P_{18.8}$ amorphous alloy was found to start within 5 minutes with the primary crystallization of α-iron. This step is followed by the eutectic crystallization of the stable phases α-iron and Fe_3P. (9 refs.)

71880 Study by X-ray and neutron diffraction of the structure of ex-carbonyl amorphous iron. J.-P.Lauriat (Lab. de Cristallographie et Phys. des Materiaux, Univ. de Paris-Sud, Orsay, France).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.77-91 (April 1983).
Ex-carbonyl amorphous iron is a heterogeneous finely powdered material. Its texture established by standard physico-chemical analysis is compatible with the diffraction data: two phases have been identified, an amorphous ferromagnetic phase homogeneous up to 300 Å containing less than 1% carbon in solution and an unstable phase coming from a part of the CO from the decomposition of carbonyl and representing 7.2% by weight. The pair distances from both X-ray and neutron diffraction spectra are identical after taking into account measurement error: the shorter pair distances are those already found in icosahedral structures, and higher distances, identified up to 19 $Å^{-1}$, are simple exact combinations of the shorter ones. (16 refs.)

71881 Computer modelling of amorphous magnetic materials. M.E.Lines (Bell Labs., Murray Hill, NJ, USA).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.1-25 (April 1983).
A review of the techniques of computer modelling of amorphous magnetic materials is presented. The magnetic materials discussed fall mainly into three categories, the ferromagnetic transition-metal metalloid alloys, the 'ferrimagnetic' transition-metal rare-earth alloys, and the speromagnetic amorphous magnetic insulators. Although all have primarily been computer modelled using simulations based on a common structural concept—that of the dense random packing of hard spheres (DRPHS)—details of the various modelling techniques are different for each. After introducing the basic DRPHS technique for the simplest possible case involving spheres of one size, and a discussion of its relevance in describing the rather unstable amorphous elemental magnetic metals, the importance of a subsequent relaxation (or energy minimization) of the hard-sphere aggregation into 'soft'-sphere equivalents is expressed. Comparison with experiment occurs primarily via the diffraction measurement of radial distribution functions. The review then progresses to an analysis of binary hard-sphere asemblies corresponding to stable amorphous magnetic alloys, and sets out convincing experimental evidence for the importance of chemical bonding in the metalloid systems. It focuses, in particular, on the ways in which such bonding forces can be accommodated within computerized building schemes both at the hard-sphere and soft-sphere levels of the development. Although chemical constraints are certainly less severe in the amorphous transition-metal rare-earth alloys, evidence for their possible importance in this context is also covered. (107 refs.)

71882 First investigations of the vitreous crystal phase of 1-cyanoadamantane obtained by quenching of the plastic phase. J.L.Sauvajol, M.Foulon, J.P.Amoureux, J.Lefebvre, M.Descamps (Lab. de Dynamique des Cristaux Moleculaires, Univ. de Lille I, Villeneuve d'Ascq, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.521-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
It has recently been shown the possible existence of glasses of a new kind, obtained by the quenching of some molecular crystals initially in their disordered rotator phase (plastic-crystals). In this phase the average translational order of the plastic phase is preserved but the orientational disorder would be frozen. The authors report here the results of preliminary experiments on the 1-cyanoadamantane whose plastic phase can be easily supercooled even when operating with single crystals. These experiments are DSC, X-ray diffraction and Raman scattering. They can be coherently interpreted through the possible occurrence of a glassy state; on the other hand they enable us to anticipate shortly a microscopic description of this phase selectively based on the molecular orientations. (5 refs.)

71883 Glass-forming ability of the melt-quenched $(Fe_{1-y}Ni_y)_3B$ alloys. Y.Khan, V.Geiss (Inst. fur Werkstoffe der Elektrotechn., Ruhr-Univ. Bochum, Bochum, Germany).
Z. Metallkd. (Germany), vol.74, no.5, p.317-18 (May 1983).
Glass-forming ability of the $(Fe_{1-y}Ni_y)_3B$ alloys obtained by quenching from the melt has been investigated. This is found to be fair in the composition range $0 \leq y \leq 0.40$, i.e, the alloys in this composition range could easily be melt-quenched into the glassy state. For $y > 0.40$, the glass-forming ability is poor depending upon the value of y. Thermal analyses of the master alloy melts have revealed that the glass-forming ability of the $(Fe_{1-y}Ni_y)_3B$ alloys scales inversely with the degree of undercooling of the melts, i.e., the higher the undercooling of the alloy melt, the lower the glass-forming ability of that alloy. (4 refs.)

Neutron scattering equation for chemical short-range order in binary non-crystalline alloy .... See Entry 71839

Dielectric evidence for existence of two-level-systems in cyclohexanol, a 'glassy crystal' system .... See Entry 71913

Suppressing Al outdiffusion in implantation amorphized and recrystallized silicon on sapphire films .... See Entry 71985

Amorphization of germanium, gallium phosphide, and gallium arsenide by laser quenching from the melt .... See Entry 72006

Heat of crystallization and melting point of amorphous silicon .... See Entry 72081

Ionic conductivity of amorphous mNaF-nMF$_3$ thin films (M=Al, Cr) .... See Entry 72162

The effects of incorporating fluorine in amorphous germanium-silicon alloy films .... See Entry 72261

Calorimetric studies of molecular layers of yellow arsenic .... See Entry 72284

Influence of low temperature high pressure and high temperature high pressure treatment on structure and superconductivity of amorphous alloy $La_{80}Al_{20}$ .... See Entry 72528

Analysis of in situ rapid solidification of submicron Al-Ge eutectic powders using transmission electron microscopy .... See Entry 73025

61.40D Glasses

71884 The structure of $Fe_{0.8}B_{0.2-x}Si_x$ metallic glasses. L.Dargel-Sulir, M.Pyka, A.Kozlowski (Inst. of Metall., Acad. of Mining & Metallurgy, Cracow, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.435-43 (April 1983).
Structure of $Fe_{0.8}B_{0.2-x}Si_x$ metallic glasses was determined from the radial distribution function (RDF) obtained by X-ray technique, with $x=0$, 0.06 and 0.10. An attempt was made to analyze the effect of Si contents on the structure of the glasses. (14 refs.)

71885 New soft magnetic materials. B.de Ronzyova, P.Butvin, P.Duhaj.
Elektrotech. Obz. (Czechoslovakia), vol.72, no.4, p.212-16 (April 1983). In Czech.
The paper deals with some magnetic properties of amorphous metallic alloys. Besides interesting physical problems, e.g. ferromagnetism of non-crystalline solids these materials also offer significant industrial applications, namely as soft magnetic materials. Metal-metalloid alloys called metallic glasses are in principle easy to prepare and possess high permeability, low coercivity, low power losses which often suffer no deterioration upon mechanical strain. The stress is put on low magnetostrictive cobalt metallic glasses produced at the Institute of Physics of EPRC SAS in Bratislava. Experimental data concerning several magnetic properties as well as the use of metallic glasses for magnetic shielding are reported in some detail. (8 refs.)

71886 IR spectra and structures of tellurite glasses. Y.Dimitriev, V.Dimitrov (Higher Inst. of Chem. Technol., Sofia, Bulgaria), M.Arnaudov.
J. Mater. Sci. (GB), vol.18, no.5, p.1853-8 (May 1983).
It is shown with IR spectral investigations that the short range order of certain tellurite glasses, obtained from monomineral crystalline phases, is similar to that of the crystals. They may contain the following polyhedra: TeO_4-trigonal bipyramids (C_{2v} symmetry), deformed TeO_4 groups, TeO_3 trigonal pyramids (C_{3v} point symmetry), or combinations of these polyhedra. The introduction of V_2O_5 and MoO_3 in the binary glasses leads to a $TeO_4 \rightarrow TeO_3$ transition. MoO_3 delays the decay of TeO_4 groups in a wider concentration range. (17 refs.)

71887 Thermally activated crystallization of $(GeSe_2)_{70}(Sb_2Te_3)_{20}(GeTe)_{10}$ alloy glass: morphological and calorimetric study. M.T.Clavaguera-Mora, S.Sunrinach, M.D.Baro, N.Clavaguera (Dept. de Termologia, Univ. Autonoma de Barcelona, Barcelona, Spain).
J. Mater. Sci. (GB), vol.18, no.5, p.1381-8 (May 1983).
The rate of crystallization of $(GeSe_2)_{70}(Sb_2Te_3)_{20}(GeTe)_{10}$ vitreous samples was investigated by means of differential scanning calorimetry. Crystallization proceeds in two stages. The activation energy of each stage of crystallization was determined. The evolution of the microstructure during crystallization was investigated by X-ray analysis and optical and scanning electron microscopy. Crystalline nuclei emerge in the bulk and develop in a spherulitic form. A lamellar structure is clearly observed when crystallization is completed. (17 refs.)

71888 A new family of tellurite glasses. I. Glass formation. V.Kozhukharov, M.Marinov, I.Gugov (Inst. of Chem. Technol., Sofia, Bulgaria), H.Burger, W.Vogel.
J. Mater. Sci. (GB), vol.18, no.5, p.1557-63 (May 1983).
Glass formation in three-component tellurite-phosphate and tellurite-borate vitreous systems has been determined, with the latter including metal oxides or metal halides (chloride, fluoride or bromide), respectively. The results obtained have served as a base for the determination of the glass forming tendency in a number of tellurite-metaphosphate and tellurite-metaborate triple combinations. Hence a new family of tellurite glasses has been obtained. It has been established that the glass formation is most observed in alkaline, earth alkaline oxide and halide metaphosphate systems. The three-component tellurite-metaphosphate and metaborate systems investigated have been treated as partial three-component sections of the main four-component tellurite-phosphate and tellurite-borate systems also. (36 refs.)

71889 Kinetics of crystallization of ZrF_4-BaF_2-LaF_3 glass by differential scanning calorimetry. N.P.Bansal, R.H.Doremus, A.J.Bruce, C.T.Moynihan (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.233-8 (April 1983).
The kinetics of devitrification in ZrF_4-BaF_2-LaF_3(62-33-5 mol%) glass were studied by isothermal and nonisothermal methods using differential scanning calorimetry. The crystallization reaction followed the Avrami equation, $x=1-\exp[-(kt)^n]$, where x is the fraction crystallized after time t. The rate constant k obeyed an Arrhenius equation. The value of the Avrami exponent, n, was 3.2 ± 0.2, indicating three-dimensional crystal growth at a constant number of nucleation sites. Values of kinetics parameters obtained from isothermal and nonisothermal techniques were in excellent agreement. The heat of crystallization measured from isothermal peaks was computed to be 38.5 ± 3.5 J/g. (28 refs.)

71890 Network structure of sodium and potassium borosilicate glass systems. K.Takahashi, A.Osaka (Dept. of Industrial Chem., Okayama Univ., Okayama, Japan), R.Furuno.
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.15-26 (April 1983).
Molar volumes and optical absorption spectra of Ni^{2+} ions were measured for sodium and potassium borosilicate glasses of the compositions $xR_2O.B_2O_3.rSiO_2$($0.01<x<2.0$; $r=1$ and 2), where parameters x and r represent respectively the molar ratios R_2O/B_2O_3 and SiO_2/B_2O_3. The presence of structural groups was discussed from the results. It was confirmed that addition of an alkali oxide changed BO_3 units to RBO_4 units in the range $x<0.55$ for $r=1$ and $x<0.6$ for $r=2$, while it created $ROSiO_3$ units in the range $0.55<x<0.8$ for $r=1$ and $0.6<x<0.9$ for $r=2$. In the range $x>0.8$ for $r=1$ and $x>0.9$ for $r=2$, $ROSiO_3$ and $ROBO_2$ units were created by the alkali addition. Here $ROBO_2$ units were also formed as a result of self-decomposition of RBO_4 units. The volume of void associated with a BO_4 unit was calculated and compared with the size of sodium and potassium ions. It was shown that sodium ions were small enough to be accommodated in the void whereas potassium ions were too large. This could explain the composition dependence of the molar volume of the sodium and potassium borosilicate glasses in the composition range $x<0.55$ for $r=1$ and $x<0.6$ for $r=2$. (21 refs.)

71891 Investigation of TiO_2-SiO_2 glasses by X-ray absorption spectroscopy. R.B.Greegor, F.W.Lytle (Boeing Co., Seattle, WA, USA), D.R.Sandstrom, J.Wong, P.Schultz.
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.27-43 (April 1983).
The coordination and nearest-neighbor bond distances of Ti in a series of TiO_2-SiO_2 glasses have been quantitatively determined using a combination of XANES and EXAFS measurements about the Ti K-edge at 4966 eV. The glasses covering the range 0.012 to 14.7 wt.% TiO_2 were prepared by flame hydrolysis of predetermined mixtures of $SiCl_4$ and $TiCl_4$ vapors. At TiO_2 concentrations below $\sim$0.05 wt.%, Ti is found in a rutile-like octahedral coordination. With increased TiO_2 content in the glass, a two-site model applies in which Ti is found predominately in a fourfold site. About $\sim$9 wt.% TiO_2, the sixfold/fourfold ratio increases appreciably and eventually at $\sim$15 wt.% TiO_2, crystalline TiO_2 segregates out as a second phase. The average Ti-O-Si bond angle in these glasses was estimated to be $\sim$159° which is slightly larger than the most probable value of 152 degrees of Si-O-Si in vitreous SiO_2. Within the accuracy of the edge shift measurements all Ti in the glass is in 4+ valence. Finally, various physical properties such as density, optical transparency and thermal expansion are correlated in light of the new structural data for this interesting binary silicate glass system. (27 refs.)

71892 Thermodynamical interpretation of the structural and enthalpic properties of the crystallization of the Fe-B glasses. C.Cunat, M.Notin, J.Hertz (Lab. de Thermodynamique Metall., Univ. de Nancy I, Vandoeuvre-les-Nancy, France), J.M.Dubois, G.Le Caer.
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.45-60 (April 1983).
The crystallization of melt quenched $Fe_{1-x}B_x$ glasses has been studied by means of differential enthalpic analysis. The crystallization enthalpies show that a phase separation at a microscopic scale prevails in the glasses with $x<0.2$, in agreement with the authors' previous Mossbauer results. The origin of this micro-phase separation is discussed. A tentative description of the thermodynamical properties of these glasses is proposed on the basis of their measurements and of the published data for the pure elements. (38 refs.)

71893 Study of sodium silicate melt and glass by infrared reflectance spectroscopy. F.Domine, B.Piriou (Lab. des Elements de Transition dans les Solides, CNRS, Meudon-Bellevue, France).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.125-30 (April 1983).
Infrared reflectance spectra and the derived absorption spectra of a Na_2O-1.41 SiO_2 glass and of the parent melt are reported. Polymers with 2 bridging oxygens per silicon (chains) and 3 bridging oxygens (sheets) are identified. Spectra of glass and melt are qualitatively similar. Melt absorption bands show a 10-30 cm^{-1} shift to lower frequencies. They are broader and less intense than those of the glass which does not agree with Sweet and White's reflectance measurements (1969) on similar glass and melt. The small differences between glass and melt can be attributed to the thermal expansion of the medium. (14 refs.)

71894 Structure analysis of $MgSiO_3$ glass. C.D.Yin, M.Okuno, H.Morikawa, F.Marumo (Res. Lab. of Engng. Materials, Tokyo Inst. of Technol., Yokohama, Japan).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.131-41 (April 1983).
The structure of $MgSiO_3$ glass was investigated by a combination of radial distribution function (RDF) analysis with an intensity comparison method on the basis of X-ray diffraction data. There appeared five peaks at 1.63, 2.08, 2.58, 3.25 and 4.2 Å in the RDF curve. The short range structure was found to be similar to that observed in pyroxenes: single chains composed of SiO_4 tetrahedra are linked by Mg^{2+} ions laterally. The Mg^{2+} ion is surrounded by six oxygen atoms on average, four of which form Mg-O pairs with an average distance of 2.08 Å and the remainder Mg-O pairs of 2.50 Å which contribute to the formation of the third peak at 2.58 Å in the RDF curve together with the O-O pairs (2.66 Å) in SiO_4 tetrahedra. The calculated intensity curve based on this model was in good agreement with the observed one. (21 refs.)

71895 New halide glasses—bromide glasses based on $ZnBr_2$. I. Vitreous zinc bromide. Hefang Hu, Fuding Ma, J.D.Mackenzie (Dept. of Materials Sci. & Engng., Univ. of California, Los Angeles, CA, USA).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.169-72 (April 1983).
The preparation and several physical properties of $ZnBr_2$ glass are presented. The glass transition temperature and the crystallization temperature were measured by DTA with a heating rate of 7.5°C/min under a flowing nitrogen atmosphere. The density of the glass was measured by a pycnometer method using hexane as a working liquid and found to be 3.77 g/cm^3. The infrared absorption spectra in the region of 4000-250 cm^{-1} were recorded using a Perkin-Elmer 457 type double beam, grating spectrophotometer. (12 refs.)

71896 Chemical short-range order and phase separation in Pr-Ga-Fe glasses. J.G.Zhao, S.G.Cornelison, D.J.Sellmyer (Behlen Lab. of Phys., Univ. of Nebraska, Lincoln, NE, USA), G.Hadjipanayis.
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.203-7 (May 1983).
The authors present X-ray diffraction and selected-area-electron diffraction and fluorescence measurements of $(Pr_{80}Ga_{20})_{100-x}Fe_x$ amorphous alloys for $0\leq x\leq 30$. Partial pair-distributions were determined and compared with calculations based on a random-occupation model. The results show that the atomic distribution is not random. The selected-area electron diffraction and fluorescence results for $x\gtrsim 20$ show the presence of a separation into Fe-rich and Fe-poor glassy phases. This phase separation plays an important role in the magnetic properties of the alloys. (7 refs.)

71897 Fast two-level systems in vitreous silica. T.Geszti (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary).
J. Phys. Colloq. (France), vol.43, no.C-9, p.481-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A model containing an extra species of tunneling two-level systems, characterized by a lower threshold 0.3K of the tunneling matrix elements, a coupling constant 0.17 eV for interaction with longitudinal sound waves, and two more parameters for the shape of their distribution function, can account for the temperature dependences of fast specific heat, thermal conductivity, sound absorption and sound velocity in vitreous silica below 2K. About 6.3 GHz, corresponding to the threshold 0.3K, a sharp rise is predicted in the frequency dependence of low-temperature (resonant) sound absorption. (11 refs.)

71898 On the problem of homogeneous nucleation in fluoride glasses. M.Matecki, M.Poulain, J.Lucas (Lab. de Chimie Minerale, Univ. de Rennes, Rennes, France), D.R.MacFarlane, C.A.Angell.
Mater. Res. Bull. (USA), vol.18, no.3, p.293-9 (March 1983).
A technique for determining the conditions under which glasses containing large quantities of fluorides become unstable against homogeneous nucleation during annealing at the glass transition temperature, is described. Its application to a system containing MnF_2, one of the better glass-promoting fluorides, suggests that most fluoride glasses produced to date are unstable against nucleation at their glass transition temperatures. This accounts for the difficulty in fabrication low scattering loss fibers by normal techniques and emphasizes the importance of developing optimized compositions over study of other properties, for this type of application. (17 refs.)

71899 Small volume change on melting as a new criterion for easy formation of metallic glasses. A.R.Yavari (Lab. de Thermodynamique et Phys.-Chimie Metall., Domaine Univ., Saint Martin d'Heres, France).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.165-8 (25 April 1983).
Using a simplified free-volume model with no adjustable parameters, a physical basis is developed for the existing correlation between the ease of glass formation and a small volume increase associated with melting. It is suggested that the fusion volume must be removed by thermal contraction, thus lowering the glass-transition temperature and reducing the stability of the amorphous phase. Furthermore, critical quench rates needed to suppress crystallisation, increase rapidly with fusion volume, as the latter increases atomic diffusivity in the undercooled liquid. (23 refs.)

71900 Compositional effects in Pd-B glassy alloys from X-ray determined radial distributional functions. G.Cocco, L.Schiffini, M.Sampoli (Univ. Venezia, Venezia, Italy), A.Lucci.
Phys. Status Solidi a (Germany), vol.76, no.2, p.753-62 (16 April 1983).
X-ray determined radial distribution functions of amorphous Pd-B alloys are obtained as a function of B content through the glass forming region in the range 24 to 30 at.%. The structure factors are found to exhibit no characteristic shoulder in the second halo, whereas the correlation functions show the subpeak height ratio of the second peak splitting reversed as compared with that of the generality of metal-metalloid glassy alloys. The experimental results are discussed in terms of a model of the dense random packing of hard spheres. Specific chemical interactions are surmised to explain distinguishing features developing in the radial functions of the hypereutectic glasses. (50 refs.)

71901 Nitrogen glasses containing berium. Preparation and properties. P.Verdier, L.Cohen, S.Mariotti, R.Marchand (Lab. de Chimie Minerale, Univ. de Rennes I, Rennes, France).
Rev. Chim. Miner. (France), vol.20, no.1, p.1-8 (1983). In French.
Nitrogen glasses have been prepared in the quinary system Ba-Si-Al-O-N. The influence of the big ion Ba^{2+} and the role of nitrogen have been characterized. In comparison with other systems M-Si-Al-O-N, the vitreous field in the cut BaO-SiO_2-AlN, determined at 1400°C, is more extensive and the glasses are less hard. Density and hardness increase with nitrogen content. The calculation of the anion-gramme number per volume unit and its variation with the ionic radius of M would lead to the glass structure understanding. (10 refs.)

71902 The kinetics of structural relaxation in amorphous $Fe_{40}Ni_{40}P_{14}B_6$. M.E.Sonius, B.J.Thijsse, A.van den Beukel (Lab. of Metall., Delft Univ. of Technol., Delft, Netherlands).
Scr. Metall. (USA), vol.17, no.4, p.545-8 (April 1983).
The slow irreversible increase of the resistivity during structural relaxation of Metglas 2826 can be ascribed to the annealing out of free volume. The kinetics of the process is in agreement with a model proposed by A. van den Beukel and S. Radelaar (see Acta Met., vol.31, no.3, p.419-27, 1983). The effect of the amount of free volume on the ordering rate (CSRO) was also demonstrated in a quantitative way. (9 refs.)

71903 Short range order in $(Ni_{65}Fe_{35})_{77}B_{23}$ metallic glass by neutron diffraction. E.Svab, N.Kroo (Central Res. Inst. for Phys., Budapest, Hungary), S.N.Ishmaev, I.P.Sadikov, A.A.Chernyshov.
Solid State Commun. (USA), vol.46, no.4, p.351-3 (April 1983).
The $S(Q)$ structure factor of $(Ni_{65}Fe_{35})_{77}B_{23}$ metallic glass was measured by time-of-flight neutron diffraction up to 24 $Å^{-1}$ momentum transfer. The distribution of transition metal-boron and transition metal-transition metal first neighbour atom pairs is resolved in the distribution function obtained from $S(Q)$ by Fourier transformation. The distances of these first neighbours pairs, the width of their distribution, the partial coordination numbers and the short range order parameter are given. The results on $(Ni_{65}Fe_{35})_{77}B_{23}$ and on the previously studied $Fe_{81}B_{10}$ amorphous alloys are compared. (10 refs.)

71904 Crystallization mechanism in glasses of MnO-P_2O_5 series. D.Miyazaki, Y.Hakamatsuka, T.Tsuchiya (Faculty of Sci. & Technol., Sci. Univ. of Tokyo, Noda-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.3, p.103-9 (1983). In Japanese.
The crystallization mechanism in the glasses of MnO-P_2O_5 series containing from 35 to 50 mol.% MnO has been investigated by high temperature microscope, X-ray diffraction and scanning electron microscopy (SEM) techniques. Each batch was melted for 30 minutes at 1150°C in air. Two kinds of specimens were prepared. The melts were poured onto a stainless plate to form discs for specimens of 50 mm diameter. After annealing, polished bulk specimens of 10 mm thickness were prepared for the experiments of crystallisation. The blown-films (about 10 μm thickness) were prepared from the melts for the experiments of high temperature microscope. Each bulk specimen was covered with a stainless cup and heated in the electric furnace, under the condition of uniform temperature distribution. Each crystallization temperature was determined by DTA method. The precipitated crystals were determined by X-ray diffraction analysis to be mainly manganese pyrophosphate ($Mn_2P_2O_7$). The specimens containing $35\sim45$ mol.% MnO from SEM on the fractured surface showed a fiber-oriented structure due to one-dimensional crystal growth from the surface toward the interior. (16 refs.)

71905 Microstructures of glassy and metastable crystalline phases formed from Fe-C ternary alloys. E.Hornbogen, I.Schmidt (Inst. fur Werkstoffe, Ruhr-Univ. Bochum, Bochum, Germany).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.199-204
Fe-C-base alloys were rapidly cooled from the liquid and then reheated from ambient temperature. In addition to the transition metal elements (V,Cr,Mo,W), B was added as a third element to substitute C. A systematic approach to the understanding of phase and microstructures, which form under these conditions is the purpose of this work. This includes the considerations of forming ability and thermal stability of metallic glasses. Three aspects require attention: (a) absolute stability of the glass phase, (b) relative stability i.e. the difference of free energy between the amorphous and particular crystalline phases, (c) kinetic stability based on the rate and mechanisms of crystallization reactions including the rate determining diffusion process. Light and electron microscopy and electron diffraction were used for the analysis of the structure of the alloys. (7 refs.)

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting ....See Entry 69790

The glass as an elastic continuum ....See Entry 71380

Relation between the chemical short-range order in liquid and amorphous alloys ....See Entry 71865

Shear band interactions with crystals in partially crystallised metallic glasses ....See Entry 71979

Low frequency elastic properties of glasses at low temperature ....See Entry 72046

Ultrasonic study of lithium borate glasses ......See Entry 72059

Thermoelastic and relaxational properties of dielectric and metallic glasses at low temperature ......See Entry 72071

A molecular orbital model of melting and glass formation ......See Entry 72091

A statistical mechanical model for chemical disorder in interacting systems: Application to phase separation in alkali silicates, alkaline earth silicates and alkaline earth aluminosilicates ......See Entry 72121

Influence of solidification parameters on the microstructure of rapidly quenched Fe-Ni-B alloys ......See Entry 72131

Resistance of the amorphous magnetic alloy $Fe_{29}Ni_{49}P_{14}B_6Si_2$ as a function of temperature and stress ......See Entry 72372

Spin glass behavior of some rapidly quenched iron (2+) aluminosilicates ......See Entry 72612

Effect of quenching rate and annealing on ESR of Cu^{2+} and γ-induced Cd^+ in low alkali borate glasses ......See Entry 72664

State of Fe^{3+} ion and Fe^{3+}-F^- interaction in calcium fluorosilicate glasses ......See Entry 72665

Glass formation and properties of chalcogenide systems. XXVI. Permittivity and the structure of glasses As_xSe_{1-x} and Ge_xSe_{1-x} ......See Entry 72726

Optical and other physical properties of fluorophosphate glass containing $Al(PO_3)_3$ ......See Entry 72746

Raman spectra of potassium borogermanate glasses with high B_2O_3 contents ......See Entry 72790

Raman spectroscopy of calcium aluminate glasses and crystals ......See Entry 72791

Metallic glasses ......See Entry 73026

Silicon-free oxynitride glasses via nitridation of aluminate glassmelts ......See Entry 73058

61.40K Polymers, elastomers, and plastics

71906 Microstructure of semi-crystalline thermoplastics structural foams. R.H.Burton, P.R.Hornsby (Dept. of Non-Metallic Materials, Brunel Univ., Uxbridge, England).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.195-6 (May 1983).
As part of a wider investigation concerned with the processing and structural factors affecting the performance of reinforced and unmodified variants of these materials, a detailed examination has been made of the morphology within the cells of structural foam polypropylene. This is prepared by a low-pressure short-shot injection moulding process using a premix of polymer and chemical blowing agent. (3 refs.)

71907 FTIR evidence of β crystal phase formation in PVDF/PMMA blends. C.Leonard, J.L.Halary, L.Monnerie (Lab. PCSM Ecole Superieure de Phys. et Chimie Industrielles de la Ville de Paris, Paris, France).
Polym. Commun. (GB), vol.24, no.4, p.110-14 (April 1983).
Blending of PVDF with PMMA in relative amounts of around 70-30 wt.% may lead directly to the β-crystal from the PVDF, provided the blend is quenched from the melt and then annealed in the temperature range 330-390K. This important result, the interest of which is related to the piezoelectric properties of the β form of PVDF, is mainly suported by FTIR (Fourier transform infra-red) analysis focused on crystal phase nature and crystallization kinetics. (8 refs.)

71908 Local order in amorphous polystyrenes: a high-resolution ^{13}C-NMR study. J.R.Havens, J.L.Koenig (Case Western Reserve Univ., Cleveland, OH, USA).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.4, p.243-7 (April 1983).
The authors report a preliminary investigation of local order in amorphous polystyrenes with recently developed high-resolution ^{13}C-NMR techniques for solids. Samples of atactic polystyrene were chosen for two reasons: (1) They form a completely noncrystalline glass when cooled isobarically from the melt; (2) laser light scattering data have been recorded for these samples and suggest increased chain ordering as the pressure under which the sample is cooled increases (1). One way to detect the order which may exist in these materials is to monitor the localized motion of the polymer chains. Such dynamic information can be obtained through high-resolution solid-state ^{13}C-NMR. An advantage of this technique is its ability to distinguish among molecular motions in various segments of the polymer chain; for example, side chain and main chain motion can be separated spectroscopically. (14 refs.)

71909 Single-chain scattering in heterogeneous block copolymers. F.S.Bates, C.V.Berney, R.E.Cohen (Dept. of Chem. Engng., MIT, Cambridge, MA, USA), G.D.Wignall.
Polymer (GB), vol.24, no.5, p.519-24 (May 1983).
Diblock copolymers consisting of polystyrene (S) attached to a polybutadiene (B) block (which is either hydrogenous or perdeuterated) have been synthesized and blended in such a way that the microphase-separated S and B domains have equal scattering-length densities, thus eliminating the component of small-angle neutron scattering (SANS) due to the domain structure. Two samples were studied: one with small spherical polybutadiene microdomains whose size was in essential agreement with calculations assuming equilibrium, and a second one of larger molecular weight in which the sphere size, while larger, was considerably smaller than predicted from equilibrium theory. The SANS spectra of these samples were analysed to give the radii of gyration R_g and molecular weights M_w of the labelled polybutadiene blocks from plots of I^{-1} versus Q^2 and least-square fits to the single-chain scattering function proposed by Debye. Results for the first sample agreed with the molecular weight obtained from chromatography and UV absorption and with the R_g found in bulk polybutadiene of similar M_w. The SANS estimates of both M_w and R_g for the second sample were anomalously large; these deviations may be due to (a) nonGaussian conformations of the polybutadiene chains imposed by the nonequilibrium state of the microdomain, or (b) clustering of the deuterated polybutadiene chains within the microdomain due to small isotopic differences in chemical potential, enhanced by the larger M_w. Observations on other systems suggest that the second effect is the dominant one. (30 refs.)

71910 Anisotropy of X-ray structural parameters of the three phase model in cellulose I. P.S.Mukherjee, G.B.Mitra (Dept. of Phys., Indian Inst. of Technol., Kharagpur, India).
Polymer (GB), vol.24, no.5, p.525-8 (May 1983).
Anisotropy of X-ray structural parameters of the three phase model proposed by Mitra and Mukherjee (1980) has been investigated in the case of cellulose fibres of ramie, hemp and jute. The structural parameters have been determined separately from each of the observable equatorial reflections. The parameter degree of crystallinity as defined in the model is in fact anisotropic at least in the samples studied. The parameter degree of paracrystallinity introduced by Mitra and Mukherjee was also found to be anisotropic. Several important correlations between the structural parameters have been drawn. It has been observed, in agreement with the recent findings of Hosemann and Balta Calleja (1980) that the greater the paracrystalline distortion, the smaller the 'paracrystallite size'. (10 refs.)

Second Mini-Symposium on Polymer Blends, 'Polyblends '82' ......See Entry 69781

Branched polymers with a prescribed number of cycles ......See Entry 70008

Link between the conformation of macromolecules and the morphology of polyoxymethylene ......See Entry 71043

The circular dichroism of cholesteric cellulose acetate solutions; dependence on molecular weight ......See Entry 71869

Effect of irradiation on density of polymers ......See Entry 72028

Phase separation in epoxy resins containing polyethersulphone ......See Entry 72124

Some aspects of the miscibility behavior of polyester/halogenated polymer blends ......See Entry 72125

Stability of film casting of power-law liquids ......See Entry 73060

Some solid-state properties of blends of polyethylene terephthalate and polyamide-6,6 ......See Entry 73206

61.50 CRYSTALLINE STATE

(inc. molecular motions in solids; for magnetic structure and spin systems, see 75.25)

71911 Huckel and Mobius boundary conditions for solids and orbital symmetry correlation in the rotational phase transition of molecular crystals. Ying-Nan Chiu (Inst. of Chem., Acad. Sinica, Nankang, Taiwan).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.26-30 (6 May 1983).
A new cyclic boundary condition which corresponds to a Mobius strip representation of a one-dimensional crystal is introduced. It is compared with the usual Bloch and Born-von Karman boundary condition which is shown to be a Huckel condition in the sense of LCAO MO treatment of a ring structure. The potential relevance of this Mobius condition to one-dimensional molecular and liquid crystals in which the relative molecular orientation changes during phase transition is alluded to. A comparison of the energies for the twisted and nontwisted form of the linear crystal is derived in the LCAO approximation. The orbital symmetry correlation in the concerted twist of the atomic or molecular orbitals along the linear backbone during a rotational polymorphic structural transition is also derived. (17 refs.)

71912 Neutron scattering study of the reorientational motions in $Cr(CO)_3(\eta^6C_6H_6)$ and $Mn(CO)_3(\eta^5C_5H_5)$. G.Lucazeau, K.Chhor (Lab. Chimie-Phys. du Solide, Univ. Paris-Nord, Villetaneuse, France), C.Sourisseau, A.J.Dianoux.
Chem. Phys. (Netherlands), vol.76, no.2, p.307-14 (15 April 1983).
Incoherent quasi-elastic neutron scattering experiments, using different resolutions and a wide Q range, have been performed on polycrystalline samples of $Cr(CO)_3(\eta^6C_6H_6)$ and $Mn(CO)_3(\eta^5C_5H_5)$ in the 280-320K temperature range. Aromatic rings are involved into a reorientational process characterized by an activation energy of ≈ 16 kJ mol^{-1} and by correlation times of the order of 2×10^{-11} s and 5×10^{-11} s at 300K for C_6H_6 and C_5H_5 rings respectively. Experimental elastic incoherent structure factors are in agreement with the $2\pi/6$ and $2\pi/5$ jump models and the fitted spectra confirm these models. From a comparison with heat-capacity results the authors conclude that $M(CO)_3$ groups are fixed during the reorientational process. Finally a comparison with literature data is presented. (23 refs.)

71913 Dielectric evidence for existence of two-level-systems in cyclohexanol, a 'glassy crystal' system. G.P.Singh (Max-Planck Inst. fur Festkorperforschung, Stuttgart, Germany), R.Vacher, R.Calemczuk.
J. Phys. Colloq. (France), vol.43, no.C-9, p.525-7 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Cyclohexanol exhibits a 'glassy' crystal phase at low temperatures. In this phase the mass centers of the molecules form a crystalline lattice, but the orientations of the molecules are disordered. The authors have measured the dielectric constant of these crystals in temperature range 0.4K to 20K at a frequency of 11 GHz. At low temperatures the dielectric constant decreases logarithmically with temperature and increases again at higher temperatures. This behaviour is similar to the low temperature dielectric behaviour of amorphous dielectrics with spatial disorder and may be interpreted in terms of existence of two-level systems with a constant density of states. Examination of two samples with different water contents shows that the water does not have any significant influence on the density of states and transverse dipole moment of the two-level-systems. (8 refs.)

First investigations of the vitreous crystal phase of 1-cyanoadamantane obtained by quenching of the plastic phase ......See Entry 71882

On the magnetic behaviour of some hydrogen bonded molecules in crystals ......See Entry 72576

NMR study of solid perfluorocyclobutane ......See Entry 72693

Molecular reorientations of 1-bromo- and 1-iodo-adamantanes—^{1}H NMR relaxation study ......See Entry 72694

NQR study of the molecular motions of the ClO_3^- ion in chlorates ......See Entry 72696

A Raman spectroscopic study of the plastically crystalline state of organic compounds ......See Entry 72782

Raman studies of vibrational and reorientational relaxation in rotator phase perfluorocyclohexane ......See Entry 72793

61.50C Physics of crystal growth

(for techniques of crystal growth and film deposition, see 81.10 and 81.15; for epitaxy, thin films, see 68.55; for whiskers, see 68.70)

71914 The effect of the microscopic structure on formation of characteristic layered inclusions in the single crystal of potassium acid phthalate (KAP). Zhao Qing-lan, Chen Jin-zhang, Huang Yi-sen (Fujian Inst. of the Structure of Matter, Acad. Sinica, Fuzhou, China).
Acta Phys. Sin. (China), vol.32, no.3, p.294-300 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The formation of characteristic layered inclusions in the single crystal of potassium acid phthalate (KAP) is discussed in view of the effect of its microscopic structure. That three types of microstructural channels trap the impurities or other different phase precipitates in solution, via a special pair of the conical planes with the highest growth rate and the fluctuation of the growth conditions in liquor, is the main mechanism of inclusion formation.

The above argument is in fair agreement with the experimental results for real crystals. (9 refs.)

71915 Convection in melt growth—theory and experiments. N.Kobayashi (Dept. of Appl. Phys., Toyama Univ., Takaoka, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1206-15 (Nov. 1982). In Japanese. [received: March 1983]
Recently it has become possible using transparent melts to simulate convection by computer and to use simulation results to control melt growth. The use of uplift methods to control melt growth and to achieve a high quality crystal is central to this whole process. Natural and forced convection and mixed convection in TeO_2, $Pb_5Ge_3O_{11}$, $Y_3Al_5O_{12}$, $Gd_3Ga_5O_{12}$ and $Dy_3Al_3O_{12}$ are reviewed. (76 refs.) *M.O.*

71916 Material design. T.Iizuka (Optoelectronics Joint Res. Lab., Kawasaki, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1293-4 (Nov. 1982). In Japanese. [received: March 1983]
The general principles of material design as they relate to mixed semiconductor materials such as the Group II to V elements and their alloys are discussed. Principles used include near periodic neighbour combinations with complex ratios and crystal substitutions, structural design such as heterogeneous material interfaces and crystal defects, control of existing materials and total control of crystal formation techniques. (4 refs.) *M.O.*

71917 What is a crystal growth unit?. H.Komatsu (Tohoku Univ., Sendai, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1297-8 (Nov. 1982). In Japanese. [received: March 1983]
Crystal growth in general is reviewed. Recent developments, in US crystal growth methods, the growth of crystals of $Na_5P_3O_{10}.6H_2O$, SiC, CdS and the CZ and FZ methods are described. (no refs.) *M.O.*

Growth kinetic limitations during rapid solidification ....See Entry 72088

The crystal growth of refractory compounds ....See Entry 72974

Observation of defects in mercury cadmium telluride crystals grown by chemical vapor transport ....See Entry 72975

Horizontal vapor transport process of $Pb_{1-x}Sn_xTe$ in a closed tube ....See Entry 72976

The chemical transport of scandium(III)-fluoride by means of silicon tetrachloride and germanium tetrachloride ....See Entry 72977

Crystal growth of refractory compounds from solutions in metallic melts ....See Entry 72979

Growth of dislocation-free bulk silicon crystals ....See Entry 72982

Temperature gradient zone melting ....See Entry 72986

61.50E Crystal symmetry; models and space groups, and crystalline systems and classes

71918 Configurations in crystals, rod lattices, and lamellar systems. H.-R.Trebin (Inst. fur Theoretische Phys., Univ. Regensburg, Regensburg, Germany).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1381-4 (2 May 1983).
For three-dimensional ordered media of periodic and partially periodic structure, homotopy theory allows the existence of nonsingular stable distortion fields, which are finite in size and thus resemble extended particles. It is shown that because of integrability conditions homotopy arguments are not adequate for these systems. By methods of differential topology, it is proved that in three dimensions topological particles of this type are unstable, but that there are analogous fields in higher dimensions that cannot decay to a uniform ground state. (31 refs.)

Algebraic investigations in Landau model of structural phase transitions. I. Group lattices and lattices of stability spaces ....See Entry 72077

61.50J Crystal morphology and orientation

71919 Thermal-field rearrangement of faces at the tips of silicon points. P.G.Borzyak, A.A.Dadykin (Inst. of Phys., Acad. of Sci., Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.67-70 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1288-91 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors use field emission microscopy to study the change in shape of monocrystalline semiconductor points under the influence of temperature and electric field. They measure the field-emission current from small areas of the tip and to obtain the surface distribution, and then to employ these data to obtain information on changes in shape. By using images obtained from a scanning electron microscope, it was possible to directly determine the dimensions of the crystalline faces and their changes. (4 refs.)

Lamellar morphology and inner structure of crystalline carbyne fragments ....See Entry 71924

Morphological stability of electron beam melted aluminum alloys ....See Entry 72090

61.50K Crystallographic aspects of polymorphic and order-disorder transformations

71920 Modification of the pair approximation of the quasi-chemical ordering theory of binary systems. V.A.Klimenko (Faculty of Math., Ural Polytech. Inst., Sverdlovsk, USSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.42-55 (16 March 1983).
A modified pair variant of the quasi-chemical ordering theory of binary systems is constructed. It is shown that the proposed approximation gives the satisfactory description of the first-order phase transition in the binary alloys with the FCC lattice. A comparison is made of the results received for the temperature changing of the long order parameter with the experiment and results of cluster variation method, where tetrahedrons represent the initial clusters. The application of the proposed method to the alloys with BCC-lattice leads, as it is in the ordinary pair variation of the quasi-chemical approximation, to the known result, that the order-disorder transition in these systems takes place as a second-order phase transition. The connection between the proposed variant of the quasi-chemical theory and the Bragg-Williams-Gorsky ordering theory is established. (36 refs.)

Synthesis and characterisation of the crystalline phases of the system PbF_2-ZrF_4 ....See Entry 71950

Order-disorder transitions and solid state reaction kinetics in Na_2SO_4-K_2SO_4 system. I ....See Entry 72098

Electrical conductivity and phase transition studies on pure and doped (Cd^{2+}, Gd^{3+}) $KNaSO_4$ and $K_3Na(SO_4)_2$. II ....See Entry 72099

61.50L Crystal binding

71921 Variable anion polarisability in ionic crystals. G.Raghurama (Dept. of Phys., Indian Inst. of Sci., Bangalore, India), R.Narayan.
Curr. Sci. (India), vol.52, no.5, p.210-12 (5 March 1983).
The authors use an empirical relation to re-estimate the polarisabilities of ions in the alkali halide and alkaline earth chalcogenide crystals. They assume a constant polarisability for cations in line with the results of Mahan (1980), while for the anions they propose a specific dependence on the interionic distance. (15 refs.)

71922 Long-range Van der Waals forces between restricted-dimensional metals. Swee Lian Tan, P.W.Anderson (Bell Labs., Murray Hill, NJ, USA).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.23-5 (6 May 1983).
Long-range Van der Waals interactions have been studied in low-dimensional metals such as graphite and polyacetylene. These forces are qualitatively and quantitatively different from the sum of the usual $1/r^6$ dispersion forces. (14 refs.)

71923 Lattice energy of alkali halide crystals. R.B.Yadav (Phys. Dept., Memorial Univ. of Newfoundland, St. John's Newfoundland, Canada).
Solid State Commun. (USA), vol.46, no.4, p.341-2 (April 1983).
A new repulsive term in the ionic interaction potential, $\psi(r) = Ar^{-n}e^{-r/\lambda}$, is suggested and the three unknown parameters A, λ and n are evaluated. Lattice energies of alkali halide crystals are calculated using this form. The results agree fairly well with the experimental values. (10 refs.)

Modification of the pair approximation of the quasi-chemical ordering theory of binary systems ....See Entry 71920

Stability and lattice contraction of small platinum particles ....See Entry 71927

The alkaline earth hydrogen fluorides $SrF(HF_2)$ and $BaF(HF_2)$ [crystal structure] ....See Entry 71934

Density-functional theory for solid nitrogen and carbon dioxide at high pressure ....See Entry 71938

Crystal and molecular structure of hexadecamethylcyclooctasiloxane, $[(CH_3)_2SiO]_8$ ....See Entry 71953

On calculated energies of segregation, grain boundary energies and lattice energy functions ....See Entry 71976

Diatomic molecules and metallic adhesion, cohesion, and chemisorption: a single binding-energy relation ....See Entry 72339

61.55 SPECIFIC STRUCTURE OF ELEMENTS AND ALLOYS

61.55D Nonmetallic elements

71924 Lamellar morphology and inner structure of crystalline carbyne fragments. V.M.Melnitchenko, B.N.Smirnov, V.P.Varlakov, Yu.N.Nikulin, A.M.Sladkov (A.N. Nesmeyanov Inst. of Organo-Element Compounds, Acad. of Sci., Moscow, USSR).
Carbon (GB), vol.21, no.2, p.131-3 (1983).
By means of transmission scanning electron microscopy and electron diffraction the morphology and the inner structure of crystalline carbyne fragments have been studied. The crystalline specimens of carbyne have been obtained by free vaporization in the arc of spectroscopically pure carbon and the subsequent condensation in vacuo on a freshly sliced rock salt crystal. The basic morphological unit has been shown to appear as a thin transparent platelet (lamel) of ~100 Å of thickness. (16 refs.)

61.55F Metallic elements

71925 Structure factors for electrons of chromium and iron determined from double refraction effect in electron diffraction. K.Fujita (Coll. of Technol., Kyoto Tech. Univ., Kyoto, Japan).
Mem. Fac. Ind. Arts Kyoto Tech. Univ. Sci. & Technol. (Japan), vol.31, p.72-82 (Dec. 1982). [received: May 1983]
Fine polyhedral particles of chromium (cube) and iron (rhombic dodecahedron) were prepared by evaporating metals in argon gas at a low pressure (Kimoto et al., 1963). An electron diffraction spot from these particles split into a multiplet due to a double refraction effect, as was observed for the cubic particles of magnesium oxide. By analyzing the multiplets, mean inner potential V_0 and Fourier coefficient V_h of chromium and iron were determined. In the case of iron no effect of magnetization of multiplets was detected. (15 refs.)

71926 Symmetry analysis of α-U by neutron diffraction. J.C.Marmeggi (Lab. de Cristallographie, CNS, Grenoble, France).
Solid State Commun. (USA), vol.46, no.4, p.277-81 (April 1983). In French.
Using polycrystalline samples of α-U, careful experiments yield precise neutron diffractograms, taking advantage of a linear multiwire detector. The authors could refine profile and integrated intensities of very weak satellite reflections of first and for some of them of second order. The modulated structure is re-examined. The structure at room temperature may be noncentred. (19 refs.)

71927 Stability and lattice contraction of small platinum particles. S.N.Khanna, J.P.Bucher, J.Buttet (Inst. de Phys. Experimentale, Ecole Polytech. Federale, Lausanne, Switzerland), F.Cyrot-Lackmann.
Surf. Sci. (Netherlands), vol.127, no.1, p.165-74 (April 1983).
The structural stability of Pt clusters of cuboctahedral and icosahedral shapes has been analytically studied by taking an approximation based on the second moment of the density of states to calculate the cohesive energy. The predictions of this model are in agreement with the phenomenological ideas of Ino's (1969) model and the known experimental results for the transition from cuboctahedral to icosahedral geometrical structure. The agreement between the calculated values for the contraction of the interatomic distance as a function of decreasing size, and very recent experimental results is excellent. (19 refs.)

The dependence of the friction coefficient on the crystal structure of solids: physical principles ....See Entry 72044

Structural and electronic properties of Fe and TiFe from extended and near-edge X-ray-absorption structure ....See Entry 72887

61.55H Alloys

71928 On a new ternary arsenide $NiNbAs_2$: structure and properties. El Houssine el Ghadraoui, R.Guerin, J.Padiou, M.Sergent (Univ. de Rennes-Beaulieu, Rennes, France).

C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.8, p.617-20 (28 Feb. 1983). In French.

$NiNbAs_2$ is orthorhombic, with space group Pnma and unit cell parameters a=5.624 (3), b=3.510 (1), c=12.496 (6) Å. The structure refined by full-matrix least-squares down R=0.061 (R_ω;0.075) is isostructural with those of $NiNbP_2$ and $NiTaP_2$. Magnetic and electrical measurements exhibit the metallic behavior of this new arsenide. (6 refs.)

71929 Crystal structure and magnetic state of pseudobinary intermetallic compounds $Ho(Co_{1-x}Ni_x)_5$. V.V.Chuev, V.V.Kelarev, A.N.Pirogov, S.K.Sidorov, V.S.Koryakova (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).

Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.510-19 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*

Neutron and X-ray diffraction methods were used in the range 1.8-1000K to study intermetallic compounds belonging to the $Ho(Co_{1-x}Ni_x)_5$ system. The crystal structure was determined for two series of samples with the compositions $HoCo_{5.5-5.5x}Ni_{5x}$ and $HoCo_{5-5x}Ni_{5x}$. It was found that the Ni atoms occupied preferentially the $2c$ positions, whereas the Co atoms occupied the $3g$ positions; the coordinates of the atoms were determined more accurately and also the occupancy of the positions in the $TbCu_7$ structure. An analysis of the magnetic structure was made and the orientations of the magnetic moments were found relative to the crystallographic axes. A magnetic phase diagram was plotted. The composition dependences of the sublattice magnetizations $M_{Ho}(x)$, $M(d_{2c})(x)$, and $M(d_{3g})(x)$ were determined. (26 refs.) *A.T.*

71930 The structure of Cr-Al alloys exhibiting anomalous physical properties. S.V.Sudareva, V.A.Rassokhin, A.F.Prekul (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).

Phys. Status Solidi a (Germany), vol.76, no.1, p.101-6 (16 March 1983).

An electron diffraction study is made of a quenched Cr-25 at.% Al alloy exhibiting anomalous physical properties. An intensive diffuse scattering, complicated in form, with intensity maxima belonging to the ordered β-phase (Cr_2Al) and the recently observed x-phase is detected. The diffuse scattering, including intensity maxima from the β- and x-phases, is prone to vanish regularly, namely the zero-intensity line is always perpendicular to the reciprocal-space vector, and this indicates that the scattering arises from transversely polarized 'soft' modes. An analysis of the reciprocal lattice of Cr-Al alloys permits the conclusion that the diffraction picture produced by the x-phase may be described by the incommensurate ω-phase known in the literature. The detected structure qualitatively explains anomalies in the physical properties of Cr-Al alloys. (13 refs.)

71931 A comparative analysis of the ordering kinetic laws for the derivation of the vacancy mobility parameters in concentrated alloys. E.Balanzat, M.Halbwachs (Dept. de Recherche Fondamentale, CENG, Grenoble, France).

Phys. Status Solidi a (Germany), vol.76, no.2, p.667-73 (16 April 1983).

It is shown that, under particular experimental conditions, the use of chemical kinetics to analyse the time evolution of short range order may lead to activation energies significantly different from the ones obtained by assuming a spectrum of ordering rates. Reanalysis of previous results in a Ag-8.75 at.% Zn alloy indicates that the latter approach yields energy values in close agreement with the ones obtained by determination methods non based on ordering kinetic considerations, while the former leads, in this specific case, to results at variance with 'best' values. It is concluded that a proper analysis of ordering kinetics has to take into account the inherent existence of a distribution of ordering rates. (17 refs.)

71932 The atomic structure of $(Mn_{1-x}Cr_x)_5Si_3$ and $(Mn_{1-y}Fe_y)_5Si_3$ solid solutions. E.N.Babanova, P.V.Gel'd, Z.A.Istomina, N.I.Sychev.

Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.567-70 (April 1983). In Russian.

X-ray and neutron diffraction investigations have been performed for $(Mn_{1-x}Cr_x)_5Si_3$, $0 \leq x \leq 0.2$, and $(Mn_{1-y}Fe_y)_5Si_3$, $0 \leq y \leq 0.2$, alloys at 293K. It is found that Fe replaces Mn in the $4d$ positions and Cr replaces Mn in the $4d$ and $6g$ positions equally. The impurity atoms in the $4d$ positions form the ordering structure. (3 refs.)

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting ....See Entry 69790

First-principles calculations of cluster densities of states and short-range order in Ag_cPd_{1-c} alloys ....See Entry 72288

Ligand field calculation of the relative displacements of the *d* band in V_3X system ....See Entry 72297

Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy ....See Entry 72638

Structural and electronic properties of Fe and TiFe from extended and near-edge X-ray-absorption structure ....See Entry 72887

Phase equilibria in the Sm-Re-B system ....See Entry 73069

High-resolution electron microscopy study of a Ti-1.6 at.% N alloy ....See Entry 73090

61.60 SPECIFIC STRUCTURE OF INORGANIC COMPOUNDS

71933 Crystal structures of several silicon carbide polytypes belonging to a special structure family. Guo Chang-lin (Shanghai Inst. of Ceramics, Shanghai, China).

Chin. Phys. (USA), vol.3, no.1, p.54-64 (Jan.-March 1983). [received: May 1983]

Silicon carbide is a typical layered compound with over 150 known polytypes. The author has developed a special Laue method, which can be effectively used to determine polytypes, and 85 new polytypes of SiC were found. Oscillation and Weissenberg methods were used to determine the structures of these new polytypes without success due to the presence of diffraction spots of basic polytypes $6H$, $15R$, and $8H$ in these photographs. This is due possibly to the small size of the new polytypes in bulk crystals, and also due to the fact that these new polytypes are embedded in large $6H$, $8H$, and $15R$ polytypes. A modified Laue method for determining the crystal structures of SiC polytypes was developed, as well as a method for calculating the diffracion intensities of the Laue spots. The calculation of the structure factor F_{hkl} in $[(33)_m32]_3$, $[(33)_m34]_3$, $[(22)_m23]_3$, and $[(44)_m43]_3$ structure families was simplified. By using this method, the crystal structures of 9 new polytypes of SiC were determined. These structures, designated by the Z stacking sequences (Zhdanov notation), are $231R$: $[(33)_{12}32]_3$, $249R$: $[(33)_{13}32]_3$, $321R$: $[(33)_{17}32]_3$, $339R$: $[(33)_{18}32]_3$, $237R$: $[(33)_{12}34]_3$, $417R$: $[(33)_{22}32]_3$, $453R$: $[(33)_{24}34]_3$, $93R$: $[(44)_3 43]_3$, $261R$; $[(44)_{10}43]_3$. (27 refs.)

71934 The alkaline earth hydrogen fluorides $SrF(HF_2)$ and $BaF(HF_2)$ [crystal structure]. W.Massa, E.Herdtweck (Fachbereich Chem., Univ. Marburg, Marburg, Germany).

Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.5, p.509-12 (15 May 1983). In German.

$SrF(HF_2)$, monoclinic, $P2_1/m$, $a=7.097$ (1), $b=3.942$ (1), $c=4.851$ (1) Å, $\beta=117.63$ (1)°, $Z=2$, $D_x=4.022$ g cm^{-3}, $V=120.24$ Å^3, μ(Mo $K\alpha$)=219.1 cm^{-1}, 621 reflections, $R_w=0.029$, $F(000)=132$. $BaF(HF_2)$, isotypic, $a=7.300$ (1), $b=4.312$ (1), $c=4.990$ (1) Å, $\beta=115.52$ (1)°, $Z=2$, $D_x=4.576$ g cm^{-3}, $V=141.75$ Å^3, μ(Mo $K\alpha$)=130.4 cm^{-1}, 675 reflections, $R_w=0.016$, $F(000)=168$. Single crystals of $SrF(HF_2)$ and $BaF(HF_2)$ have been obtained by hydrothermal high-pressure synthesis (3GPa, 573K). Their crystal structures were determined by X-ray diffractometry at 298K. The alkaline-earth ions show tricapped trigonal prismatic coordination formed by four F^- and five $[FHF]^-$ anions. As a result of the characteristic three-dimensional connection of these groups different bonding to the Sr(Ba) ions is observed for the two F atoms in the $[FHF]^-$ anions. Bond strength calculations account for asymmetric hydrogen bonds, as has been suggested previously from NMR results, and give the direction of the proton shift. The F-F distances in the $[FHF]^-$ groups corrected for thermal motion are 2.269 Å for the Sr and 2.281 Å for the Ba compound. (22 refs.)

71935 Deformation density in complex anions. IV. Magnesium thiosulfate hexahydrate, $MgS_2O_3.6H_2O$. Y.Elerman, J.E.Bats, H.Fuess (Inst. fur Kristallographie und Mineralogie, Univ. Frankfurt, Frankfurt am Main, Germany).

Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.5, p.515-18 (15 May 1983).

For pt.III see Acta Cryst. B, vol.38, p.2116 (1982). The deformation electron density in $MgS_2O_3.6H_2O$ has been determined at 120K from a combination of X-ray and neutron diffraction data. $M_r=244.56$, $Pnma$, $a=9.324$ (2), $b=14.451$ (4), $c=6.862$ (1) Å, $V=925.2$ (4) Å^3, $Z=4$, $D_x=1.756$ Mg m^{-3}, $F(000)=512$. Neutron diffraction: $\lambda=0.8410$ Å, $(\sin Q/\lambda)_{max}=1.02$ Å^{-1}, $\mu=0.158$ (1) mm^{-1}, $R_w(F)=0.047$ for 2771 independent reflections. X-ray diffraction: Nb-filtered Mo $K\alpha$, $\lambda=0.71069$ Å, $(\sin \theta/\lambda)_{max}=0.85$ Å^{-1}, $\mu=0.655$ mm^{-2}, $R_w(F)=0.026$ for 2489 independent reflections. Peaks of about 0.25 eÅ^{-3} are observed at the midpoints of the S-O and S-S bonds. Extended lone-pair regions up to 0.30 e Å^{-3} are found at the back of the sulfate O atoms. The lone-pair density at the terminal S atom is rather diffuse. All three independent water molecules show O-H bond peaks of 0.35-0.40 e Å^{-3}. Their O lone-pair peaks amount of 0.30-0.37 e Å^{-3} and are considerably extended normal to the HOH plane. (31 refs.)

71936 Synthesis and structure of orthorhombic cadmium platinum oxide, $CdPt_3O_6$. C.T.Prewitt, K.B.Schwartz (Dept. of Earth & Space Sci., State Univ. of New York, Stony Brook, NY, USA), R.D.Shannon.

Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.5, p.519-21 (15 May 1983).

$M_r=793.7$, orthorhombic, $Cmmm$, $a=7.2144$ (6), $b=10.190$ (1), $c=3.1650$ (2) Å, $V=232.67$ (6) Å^3, $Z=2$, $D_x=11.33$ g cm^{-3}, λ(Ag $K\alpha$)=0.5609 Å, $\mu=513.5$ cm^{-1}, $T=293$K, $F(000)=660$, R=0.047 for 417 unrejected reflections in the range $0.0849<\sin \theta/\lambda<0.8914$ Å^{-1}. Crystals of $CdPt_3O_6$ were grown by a hydrothermal technique. Bulk electrical-resistivity measurements on a pellet of compressed powder yielded values of $\rho(298K)=0.03$ Ωm and $E_a=0.04$ eV (1 eV=1.60×10^{-19} J) in the range 5 to 298K. This low resistivity is related to metal-metal distances of 3.165 Å in a structure which includes chains of edge-shared PtO_6 octahedra and columnar stacks of planar PtO_4 groups extending along [001]. (17 refs.)

71937 Identification of polytypes of MX_2-type compounds. II. Structures of 20 new polytypes of cadmium iodide. B.Palosz (Inst. of Phys., Warsaw Tech. Univ., Warszawa, Poland).

Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.5, p.521-8 (15 May 1983).

The identification of polytypes of crystals of MX_2 type using the intensity diagrams of the 10.l and 10.$\bar{l}$ reflexions is discussed. It is shown that these diagrams enable some standardization of the structures of simple polytypes, classifying them into structural series. The structures of 20 new polytypes of CdI_2 obtained from solutions have been determined: $16H_8$: $(t_3)f1of1tf5$; $20H_{12}$: $(t)_5f4(t)_3f5$; $22H_6$: $(t)_7f1f1tf5$; $22H_7$: $(t)_5f2(o)_2f2tf4$; $22H_8$: $tf2(o)_2f2f1f2(t)_2f1f1$; $26H_5$: $(t)_7f2(o)_2f2tf4$; $28H_5$: $(t)_9f4(t)_3f5$; $38H_2$: $(t)_{17}f1f2$; $40H_2$: $(t)_{13}f4(t)_5f5$; $40H_3$: $tf1(o)_2f1(t)_{13}f2f2$; $24R_3$: $f1f1f2f2$; $48R_2$: $f1f1tf2f1(t)_2f5$; $48R_3$: $(t)_4f4(t)_2f5$; $54R_3$: $f1f1f2(o)_3f1tf5$; $66R_1$: $f1f1(t)_5f2f1f2f2$; $66R_2$: $f1f1(t)_5f_2of1f5$; $84R_3$: $f1f1(tf2f1)_2(t)_4f2f2$; $84R_4$: $f1(o)_6f1(t)_4f2f2$; $96R_1$: $(t)_8f4(t)_6f5$; $120R_1$: $(t)_{10}f4(t)_8f5$; 18 already known polytypes have also been recognized. The uniqueness of the structures of polytypes determined by the standard a-axis oscillation method is discussed. (11 refs.)

71938 Density-functional theory for solid nitrogen and carbon dioxide at high pressure. R.LeSar (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA), R.G.Gordon.

J. Chem. Phys. (USA), vol.78, no.8, p.4991-6 (15 April 1983).

Structural properties of solid N_2 and CO_2 under pressure have been studied with a recently reported theory. The model allows for calculation of the structure and dissociation energy of molecular crystals, using no empirical parameters where dispersion energy is included as a sum of the pair interactions. Comparison with available low temperature experimental results shows good agreement with average errors in lattice constants of about 1% and in lattice energies of about 6%. Calculations were performed on nitrogen in a number of structures, including the experimentally observed $Pa3(\alpha)$, $P4_2/mnm(\gamma)$, $P6_3/mmc(\beta)$, and $Pm3n$ structures, as well as a recently proposed structure with space group $R3m$. The $R3m$ structure was found to be more stable than the $Pa3$ structure at about 10 kbar. Calculations were carried out on carbon dioxide in the $Pa3$ structure. Comparison of the calculated pressure-volume curves with room temperature experimental curves to 100 kbar shows very close agreement for both N_2 and CO_2. (34 refs.)

71939 Inelastic neutron scattering and transmission electron microscope studies of lead dioxide. P.T.Moseley (Materials Dev. Div., AERE, Harwell, England), J.L.Hutchison, C.J.Wright, M.A.M.Bourke, R.I.Hill, V.S.Rainey.

J. Electrochem. Soc. (USA), vol.130, no.4, p.829-34 (April 1983).

The complementary techniques of inelastic neutron scattering and high resolution transmission electron microscopy have been used to study different aspects of the constitution of several forms of lead dioxide. The neutron scattering techniques, which are particularly sensitive to the presence of hydrogenous species, indicate that lead dioxide can accommodate widely varying amounts of hydrogen. The vibration spectra, recorded after various dehydration procedures, do not show sharp characteristic vibrations consistent with hydroxyl groups similar to those known to be present in other hydrogen-containing oxides. They suggest that the temperature-induced changes observed are consistent with the presence of adsorbed water. There appears to be a relationship between the amount of hydrogen present in a sample of PbO_2, as measured by neutron transmission, and the proportion of reduced lead present (i.e. other than Pb^{4+}) determined by chemical analysis. The electron microscopy has allowed the direct imaging of the crystal structure of β-PbO_2. This form of lead dioxide, like α-PbO_2 is prone to coherent structure intergrowth but, unlike α-PbO_2, the range of defects present does not include planar faults. (17 refs.)

71940 Structural and magnetic data on $EuSi_2$. J.Evers, G.Oehlinger, A.Weiss, F.Hulliger (Inst. fur Anorganische Chem., Univ. Munchen, Munchen, Germany).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L19-23 (April 1983). In German.
The communication deals with determinations of the structural and magnetic properties of $EuSi_2$, which at temperatures between 300 and 1150K appears to contain double-valent Eu, and to exhibit anomalous values on the crystallographic α-axis. It was decided to measure its magnetic susceptibility at higher temperatures and to determine its structural parameters by examination of a single-crystal sample in the Siemens four-circuit diffractometer. The method of preparing the sample is described. The magnetic measurements were made on a quartz-enclosed powdered sample in a Faraday balance. The results of the measurements are given; the α-axis anomaly is discussed, but without reaching a firm conclusion. (11 refs.) *C.J.O.G.*

71941 Crystal structure of the microwave dielectric resonator $Ba_2Ti_9O_{20}$. E.Tillmanns, W.Hofmeister (Inst. fur Geowissenschaften, Univ. Mainz, Mainz, Germany), W.H.Baur.
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.268-71 (April 1983).
A single-crystal X-ray study of dibarium nonatitanate, $Ba_2Ti_9O_{20}$, yielded the triclinic space group $P\bar{1}$ with $a=0.7471(1)$, $b=1.4081(2)$, $c=1.4344(2)$ nm, $\alpha=89.94(2)°$, $\beta=79.43(2)°$, $\gamma=84.45(2)°$, $V=1.476$ nm^3, $Z=4$, and $D_x=4.61$ Mg/m^3. A refinement of atomic coordinates and isotropic thermal parameters led to a residual of 0.03. The structure consists of hexagonally closest-packed layers of Ba and O atoms in the sequence $(hch)_3$. All Ti atoms reside in octahedral interstices of this closest packing. The various Ti coordination octahedra share only edges and corners with each other. One-half of the Ba atoms is twelve-coordinated by oxygen atoms, the other half is eleven-coordinated. (33 refs.)

71942 Superconducting and magnetic properties of ternary silicides in some rare earth-noble metal (Rh or Ir)-silicon systems. B.Chevalier, P.Lejay, J.Etourneau, P.Hagenmuller (Lab. de Chimie du Solide, Univ. de Bordeaux I, Talence, France).
Mater. Res. Bull. (USA), vol.18, no.3, p.315-30 (March 1983).
New families of ternary silicides have been prepared in the RE-Rh or Ir-Si systems and the crystal structures have been determined: $RERh_3Si_2$, $RE_2Rh_3Si_5$, RE_2RhSi_3 (RE=Y, La→Er), RERhSi (Y, La, Gd→Er), REIrSi (RE=La, Ce, Nd), $RERhSi_2$ and $REIrSi_2$ (RE=La→Gd). The RE_2RhSi_3 compounds crystallize with a new structural type, the other ones are isostructural with already known silicides or borides. Some of the silicides studied whose rare earths are diamagnetic (Y, La) show superconducting transitions above 1.6K. They have been compared with other superconducting ternary borides, silicides, germanides and phosphides containing rare earths and noble metals. Except the phases with Y and La which are diamagnetic or show Pauli paramagnetism, the other materials order magnetically at low temperature. The onset of magnetic transitions vs. field has been observed for some compounds below 20 kOe at 4.2K. (31 refs.)

71943 On the crystal structure of $CrWO_2$. Y.Shimony, L.Ben-Dor (Dept. of Inorganic & Analytical Chem., Hebrew Univ., Jerusalem, Israel).
Mater. Res. Bull. (USA), vol.18, no.3, p.331-5 (March 1983).
The crystal structure of $CrWO_4$ was determined on the basis of an orthorhombic symmetry with space group F222 (no.22). Unit cell dimensions are as follows: a=13.338 Å, b=12.889 Å, c=5.8308 Å. (12 refs.)

71944 New compounds in the system SrO-TiO_2-Al_2O_3 at 1300°C. A crystallographic and leaching study. H.W.Zandbergen, D.J.W.Ijdo (Gorlaeus Labs., State Univ. Leiden, Leiden, Netherlands).
Mater. Res. Bull. (USA), vol.18, no.3, p.371-4 (March 1983).
The SrO poor part of the system SrO-TiO_2-Al_2O_3 at 1300°C in air has been investigated. Two new quarternary compound structures were determined, $SrTi_3Al_8O_{19}$ and $Sr_3TiAl_{10}O_{20}$, isostructural to $Ba_3TiAl_{10}O_{20}$. The compounds TiO_2, $SrTiO_3$, $SrAl_{12}O_{19}$ and $SrTi_3Al_8O_{19}$ are stable in water at 300°C and 2 kb. All other compounds decompose under these conditions. (11 refs.)

71945 Ternary graphite intercalation compound $KCsC_{16}$: an ideal layered heterostructure. B.R.York, S.K.Hark, S.A.Solin (Dept. of Phys. & Astron., Michigan State Univ., East Lansing, MI, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1470-3 (9 May 1983).
An ideal ternary heterostructure graphite intercalation compound, $KCsC_{16}$, which exhibits a stage-1 c-axis stacking sequence, ...CKCCsCKCCs..., has been prepared. The stage, stacking sequence, and $(2\times2)R0°$ in-plane structure have been confirmed by high-resolution X-ray diffraction studies which reveal a c-axis correlation range of ~350Å. The structure factor and widths of the $(00l)$ reflections calculated on the basis of the proposed stacking sequence are in excellent agreement with experimental observations. (13 refs.)

71946 X-ray diffraction investigation of cation distribution in high-temperature cubic spinels of the Mg-Mn-O system. V.P.Barkhatov, V.F.Balakirev, Yu.V.Golikov, E.G.Kostitsin (Inst. of Metall., Acad. of Sci., Sverdlovsk, USSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.57-63 (16 March 1983).
The concentrations of Mg- and Mn-ions in tetrahedral and octahedral sublattices in equilibrium cubic spinels $Mg_xMn_{3-x}O_4$ are determined by high-temperature X-ray method. The cation distribution parameter dependence versus x is found to be linear and temperature-independent in the 973 to 1263K temperature range. Two equally possible high-temperature cation configurations on the basis of obtained data for cubic equilibrium spinels are proposed: (1) $Mg^{2+}{}_{0.566x}\,Mn^{2+}{}_{1-0.566x}\cdot[Mg^{2+}{}_{0.434x}\,Mn^{3+}{}_{2-0.868x}\,Mn^{4+}{}_{0.434x}]O_4$; (2) $Mg^{2+}{}_{0.566x}\,Mn^{2+}{}_{1-0.566x}\,[Mg^{2+}{}_{0.434x}\,Mn^{2+}{}_{0.767-0.434x}\,Mn^{3+}{}_{0.466}\,Mn^{4+}{}_{0.767}]O_4$. (11 refs.)

71947 Crystal structure and characterization of $Cs_2Zn_3[Fe(CN)_6]_2.xH_2O$. P.Gravereau, E.Garnier (Lab. de Cristallochimie Minerale, Univ. de Poitiers, Poitiers, France).
Rev. Chim. Miner. (France), vol.20, no.1, p.68-77 (1983).
Powder and single crystals of $Cs_2Zn_3[Fe(CN)_6]_2.xH_2O$ have been prepared by ion exchange from the solid $Na_2Zn_3[Fe(CN)_6]_2.xH_2O$. All the lines of the X-ray powder pattern have been attributed in the rhombohedral system. Crystal structure of $Cs_2Zn_3[Fe(CN)_6]_2.6H_2O$ has been determined in the space group $R\bar{3}c$ with $a=13.140(3)$Å, $\alpha=56.81(2)°$, Z=2, V=1486.1±0.5 Å^3, $\rho_x=2.238$ Mg.m^{-3}; R=0.044 ($R_w=0.048$) for 481 unique reflections. FeC_6 octahedra and ZnN_4 tetrahedra are held together by the $(CN)^-$ ions making up a three-dimensional frame with large cavities as already found in previous $M_2{}^IZn_3[Fe(CN)_6]_2.xH_2O$ structures ($M^I=Na^+$, K^+). Cs^+ ions are randomly distributed near the centres of the 'windows' of the cavities and zeolitic water molecules are inside the cavities. (13 refs.)

71948 Discrete $Si_4Te_{10}{}^{8-}$ and $Ge_4Te_{10}{}^{8-}$ ions in $Na_8Si_4Te_{10}$ and $Na_8Ge_4Te_{10}$. B.Eisenmann, H.Schwerer, H.Schafer (Eduard-Zintl-Inst., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Rev. Chim. Miner. (France), vol.20, no.1, p.78-87 (1983). In German.
The new compounds $Na_8Si_4Te_{10}$ and $Na_8Ge_4Te_{10}$ crystallize in the monoclinic system, space group $P2_1/c$ with the lattice constants s. In the structure there are discrete $Si_4Te_{10}{}^{8-}$ and $Ge_4Te_{10}{}^{8-}$ anions formed by Si_2Te_6- and Ge_2Te_6-units respectively connected by common Te-bridges. (9 refs.)

71949 Structural comparison of mixed molybdates of metals (I) and (II) related to the triclinic molybdate $ZnMoO_4$. C.Gicquel-Mayer, M.Mayer (Lab. de Chimie Minerale Structurale, Univ. de Haute-Normandie, Mont-Saint-Aignan, France).
Rev. Chim. Miner. (France), vol.20, no.1, p.88-95 (1983). In French.
The crystal structures of some mixed molybdates of metals I(Na,Ag) and II (Zn,Mg) are compared. They are grouped with the same formula $A_{2-2x}{}^{I}M_{2+x}{}^{II}(MoO_4)_3$. A comparison with $ZnMoO_4$ triclinic shows only a common motif. (5 refs.)

71950 Synthesis and characterisation of the crystalline phases of the system PbF_2-ZrF_4. C.Depierrefixe (Lab. de Chimie Minerale Structurale CNRS, Limoges, France), R.M.Awadallah, J.-P.Laval, B.Frit.
Rev. Chim. Miner. (France), vol.20, no.1, p.96-108 (1983).
By solid state reaction from 300°C up top 600°C in the PbF_2-ZrF_4 system in addition to the already known $PbZrF_6$ and Pb_3ZrF_{10} compounds, two domains of non-stoichiometry, $Pb_{1-x}Zr_xF_{2+2x}$ have been characterised. The first one, very extended ($0\leq x\leq0.18$ at 550°C) corresponds to an anion-excess fluorite-like solid solution showing a strong tendency to ordering for compositions with $x\simeq0.167$. The corresponding ordered Pb_5ZrF_{14} phase is a new example of anion-excess fluorite-related superstructure (monoclinic, pseudotetragonal, $a\simeq a_F$, $b\simeq c\simeq 3a_F$). The complex phenomena of ordering have been interpreted on the basis of a model of monodimensional clusters built up with ZrF_8 antiprisms. (13 refs.)

71951 Synthesis, structural study by X-rays and by infrared and Raman spectrometry of the basic tellurite $Li_2TeO_3.LiOH$. D.Cachau-Herreillat, A.Norbert, M.Maurin, R.Fourcade, E.Philippot (Lab. de Chimie des Materiaux, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Rev. Chim. Miner. (France), vol.20, no.1, p.129-39 (1983).
Li_2TeO_3, LiOH was isolated by hydrothermal synthesis. This phase crystallizes in the monoclinic system, space group $P2_1/m$, Z=2, with $a=6.771(2)$, $b=6.309(2)$, $c=5433(2)$ Å and $\beta=113.20(1)°$. The structure determination and refinement was carried out with 695 independent reflections to a final R-value of 0.046. The crystal structure is built up from streets of discrete $TeO_3{}^{2-}$ anions and LiO_4 tetrahedra. A parallel study by IR and Raman vibration spectrometry was made. (17 refs.)

Evidence for the isomorphism of the low-temperature form of hexaamminecobalt(III) iodide with the room-temperature structure of hexaamminecobalt(III) chloride .... See Entry 71970

Ternary copper oxides with the rutile structure: the compounds $Ti_{1-x}Cu_{x/3}Nb_{2x/3}O_2$ .... See Entry 72391

Preparation and electrical conductivity of $Cr_2V_2WO_{10}$ and $Cr_2Nb_2WO_{10}$ with the rutile structure .... See Entry 72393

Magnetic properties of $REFe_2Si_2$ compounds .... See Entry 72636

Infrared and Raman spectra and X-ray diffraction studies of solid lead(II) carbonates .... See Entry 72778

Raman spectra and staging of intercalated graphite fibers .... See Entry 72781

Raman spectroscopy of calcium aluminate glasses and crystals .... See Entry 72791

Polarized Raman spectra of InS single crystal .... See Entry 72802

Preparation and optical investigation of the $CdInGaS_4$ compound .... See Entry 72803

Lattice disorder and electrical conductivity of flux-grown $Ca(WO_4)_x(MoO_4)_{1-x}$ crystals .... See Entry 72978

The ternary system CaF_2-CdF_2-CrF_3. Dimorphism of $CaCrF_5$ and CrF_3 .... See Entry 73074

The effect of the atmosphere of heat-treatment on the cobalt ions in the cobalt aluminumoxides with the spinel structure .... See Entry 73114

Normal and high pressure synthesis of mixed ruthenium-rhodium oxides of the rutile type .... See Entry 73388

61.65 SPECIFIC STRUCTURE OF ORGANIC COMPOUNDS

71952 The crystal structure of dimethyl sulphoxide complex of yttrium. Lin Yong-hua, Hu Ning-hai, Zhou Qing-lian, Liu Shu-zhen, Shi En-dong, Wang Ming-yi (Changchun Inst. of Appl. Chem., Acad. Sinica, Shanghai, China).
Acta Phys. Sin. (China), vol.32, no.3, p.400-5 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The crystal of dimethyl sulphoxide complex of yttrium $[Y(NO_3)_3.3DMSO]$ belongs to the monoclinic system, $a=13.604(4)$ Å, $b=12.669(4)$ Å, $c=11.554(2)$ Å, $\beta=100.14(4)°$ and $Z=4$. The space group is $P2_1/n$. The diffraction data were collected using PW-1100 four-circle diffractometer. The number of independent diffraction data amounts to 3615. The structure was solved by heavy-atom method. Structure parameters were refined by full matrix and block diagonal least square method to a final $R=0.080$. The result of structure analysis establishes that the polyhedral coordination of 'three-headger triprism' is formed by nine oxygen atoms surrounding the Y cation. The distances between the yttrium and the coordinating oxygens are $Y\text{-}O_{DMSO}=2.285$ Å, $Y\text{-}O_{NO(3)}{}^-=2.460$ Å. (5 refs.)

71953 Crystal and molecular structure of hexadecamethylcyclooctasiloxane, $[(CH_3)_2SiO]_8$. N.L.Paddock, S.J.Rettig, J.Trotter (Dept. of Chem., Univ. of British Columbia, Vancouver, BC, Canada).
Can. J. Chem. (Canada), vol.61, no.3, p.541-4 (March 1983).
Crystals of hexadecamethylcyclooctasiloxane are tetragonal, $a=13.9442(5)$, $c=8.5573(4)$ Å, $Z=2$, space group $P4/nnc$. The structure was solved by direct methods and was refined by full-matrix least-squares procedures to a final R of 0.034 and $R_w=0.042$ for 730 reflections with $I\geq3\sigma(I)$. The molecular structure closely resembles that of $[(CH_3)_2PN]_8$. Its comparatively rigid conformation, in which the silicon atoms form a crown, is dependent on the efficient use of van der Waals interactions between two sets of four methyl groups. Important molecular dimensions (bond lengths corrected for libration)

are: Si-O=1.629(1) and 1.635(1), Si-C=1.862(2) and 1.848(3) Å, O-Si-O=108.99(6), Si-O-Si=157.8(1) and 148.8(2)°. (35 refs.)

Study of a steric interaction effect in the benzofuran series ... See Entry 70918

Crystal structure of (DPPP)(TCNQ)$_5$(H$_2$O) and electrical properties of the mixed valence TCNQ salts of diquaternised 1,3-bis(4-pyridyl)propane .... See Entry 72394

Distribution of Cl^- and Br^- ions in mixed crystals $(CH_3NH_3)_2Cu(Cl_{1-x}Br_x)_4$ .. See Entry 72683

61.70 DEFECTS IN CRYSTALS

(see also 61.80 Radiation damage, 62. Mechanical and acoustic properties, 71.55 Impurity and defect levels, 76.30M EPR of colour centres and other defects, 78.50 Impurity and defect absorption in solids, 81.40 Treatment of materials)

71954 **Intergrowths and defect structures in $Bi_9Ti_3Fe_5O_{27}$ revealed by high-resolution electron microscopy.** D.J.Smith (High Resolution Electron Microscope, Univ. of Cambridge, Cambridge, England), J.L.Hutchison.
J. Microsc. (GB), vol.129, pt.3, p.285-93 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
A high-resolution 500 kV study of the long-period (*n*-8) perovskite $Bi_9Ti_3Fe_5O_{27}$ has revealed a variety of order/disorder effects, in marked contrast to low-*n* materials, as well as the occurrence of a new two-dimensional superlattice structure corresponding to a $3\times d_{110}$ ordering along the bismuthate layers. Intergrowths of the 2-D SL phase with the 'usual' perovskite/bismuthate phase, as well as sharp interfaces between these two phases, were observed and the common occurrence of steps along these interfaces suggested ledge migration as one possible transformation mechanism. Coherent intergrowths of structural elements rather similar to tetragonal-tungsten-bronze (TTB)-type were also found and these sometimes appeared to be relics of the super-lattice phase. The chemical implications of the various observations are briefly discussed. (17 refs.)

71955 **Nonstoichiometry of inorganic solids.** W.Albers (Philips Res. Labs., Eindhoven, Netherlands).
In book: *Current topics in materials science. Vol.10*, E.Kaldis [Ed.], p.191-247. Amsterdam, Netherlands: North-Holland (1982), vi+515 pp. [0 444 86321 4]
The author discusses some thermodynamic aspects of the nonstoichiometry of inorganic solids. An introduction to the defect chemistry of pure compounds is presented. The theoretical aspects are illustrated with thermodynamic and electrical measurements on many interesting materials. (50 refs.)

MICRO 82: High Resolution Electron Microscopy .... See Entry 69778

The effect of the microscopic structure on formation of characteristic layered inclusions in the single crystal of potassium acid phthalate (KAP) .... See Entry 71914

Crystals containing a high density of lattice defects after heavy irradiation ...... See Entry 72004

Electronic conductivity, Seebeck coefficient, and defect structure of $La_{1-x}Sr_xFeO_3$ (x=0.1, 0.25) .... See Entry 72387

Crystal defect problems .... See Entry 72984

The sintering of creep-induced cavities in a low-alloy ferritic steel (1Cr1Mo0.75V) .... See Entry 73112

61.70B Interstitials and vacancies

(exc. colour centres)

71956 **Peak representing annealing of point defects and the activation energy of the process responsible for this peak.** V.I.Levit, Yu.M.Plishkin, I.E.Podchinenov (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.426-32 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
It is shown that the relationship between the activation energy of the process of annealing of point defects and the temperature at which the annealing is maximal is valid in the case of annihilation of Frenkel pairs with short internal distances, as well as in the case of correlated recombination and free migration. An allowance is made for the emission of point defects by clusters. An example is given of the use of the consequences deduced from this relationship in the interpretation of the experimental results on annealing;. (17 refs.) *A.T.*

71957 **Distribution of nitrogen atoms between interstices in the ferrite lattice at high temperatures.** L.A.Bol'shov (Polytech. Inst., Vologda, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.615-17 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An analysis is made of the previously published results of an experimental study of the solubility of nitrogen in the ferrite phase of high-chromium steels (16.8-31.6 wt.% Cr) at temperatures 1250-1350°C. The results suggest that at about 1300°C the nitrogen atoms occupy preferentially the tetrahedral interstices in the ferrite. (9 refs.) *A.T.*

71958 **Temperature dependence of accumulation efficiency and annihilation kinetics of primary Frenkel defects in KCl and KCl-I crystals in the temperature range 15-80K.** V.V.Gavrilov, S.N.Nesterova, A.M.Sitdikov, S.A.Chernov, S.S.Etsin.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.35-42 (1983). In Russian.
Optical absorption relaxation induced by a pulse accelerator (10 ns, 250 keV, 10^2 A/cm^2) in KCl and KCl-I in the temperature range 15-80K has been studied. It is shown that when I^- is introduced in the KCl crystal the *F-H*-pair distribution shift takes places in the direction of the average distance increase in the pair. This leads to the *F-H*-pair stability increase in KCl-I as compared to pure KCl. (19 refs.)

71959 **Simulation of point defect accumulation kinetics in one-dimensional crystal.** Yu.Kh.Kalnin, Yu.Yu.Krikis.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.104-6 (1983). In Russian.
Simulation of point defect accumulation kinetics is carried out in a one-dimensional crystal. Defects pair correlations are taken into account. The obtained results are in good agreement with the theoretical model proposed previously. (5 refs.)

71960 **In-situ TEM observations of loop punching from helium platelet cavities in molybdenum.** J.H.Evans (Metall. Div., AERE, Harwell, England), A.van Veen, L.M.Caspers.
Scr. Metall. (USA), vol.17, no.4, p.549-53 (April 1983).
In an extension of earlier HDS/TEM work (see ibid., vol.15, p.323, 1981) on the nucleation and growth of helium clusters in molybdenum, the authors have demonstrated as expected that TEM specimens with (011) surfaces can successfully limit the loss of ⟨111⟩ loops to the free surface. In particular the property that two of the ⟨111⟩ glide directions lie parallel to the foil surfaces has indicated clearly that the electron beam can induce the in-situ punching of ⟨111⟩ interstitial loops from some of the helium platelets. Direct electron beam heating of the specimen was eliminated as a mechanism but two other possibilities were suggested, one based on the excitation of helium atoms to increase the internal cavity pressure, the second based on direct electron-molybdenum atom energy transfers to overcome an activation barrier for loop nucleation. Both fit the observations in the sense that the TEM beam density (electrons/unit area) seemed to be the controlling parameter. The TEM electrons also were able to initiate the glide of interstitial loops evidently pinned by helium atoms at the loop periphery. (13 refs.)

A comparative analysis of the ordering kinetic laws for the derivation of the vacancy mobility parameters in concentrated alloys .... See Entry 71931

Tendency to nearly cubic local lattice structure around interstitial hydrogen in the alkali metals .... See Entry 71984

The interaction between point defects introduced by implantation and dislocations in silicon .... See Entry 72002

Deep levels in semiconductors .... See Entry 72346

Electron and positron response to atomic defects in solids: A theoretical study of the monovacancy and divacancy in aluminum .... See Entry 72349

Effect of point defects of metal surface on the electron work function .... See Entry 72473

ESR of Fe^{3+} centers in $Na_3H(SO_4)_2$ crystals .... See Entry 72667

Influence of the distribution of carbon atoms on the quadrupole interaction in Fe-Ni-C austenite .... See Entry 72716

Determination of the ferromagnetic vacancy-formation enthalpy in α-iron by the positron method using the carbon-vacancy pair as a probe .... See Entry 72884

Lattice disorder and electrical conductivity of flux-grown $Ca(WO_4)_x(MoO_4)_{1-x}$ crystals .... See Entry 72978

Some aspects of micro-alloying .... See Entry 73092

Effect of zinc content on the annealing behaviour of deformed alpha-brasses .... See Entry 73106

61.70D Colour centres

***F*-centers: advanced laboratory experiments as a 'research project'** .... See Entry 69820

Influence of an electric field on the accumulation and annealing of radiation defects in gallium arsenide .... See Entry 72016

Optical detection of EPR using the luminescence emitted by crystal defects .... See Entry 72714

Magnetic circular dichroism of colour centres in CaF_2:Na ...... See Entry 72772

The F centre near a charged dislocation .... See Entry 72837

Effect of spin polarization, spin reorientation, and spin-lattice relaxation on the luminescence emitted by alkali-halide crystals at very low temperatures ..... See Entry 72843

Radiative unstabilities in some triple electronic colour centre systems in ionic crystals .... See Entry 72858

Hole-induced exoelectronic emission .... See Entry 72972

61.70G Dislocations: theory

71961 **Reduction of dislocations in LPE layers due to the action of thermal stresses.** Tu Xiang-zhong (Inst. of Semiconductors, Acad. Sinica, Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.315-24 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The author presents a model of the reduction of dislocations in LPE layers by the formation of ⟨110⟩ oriented interfacial dislocations parallel to the surface of the substrate due to the glide motion of substrate threading dislocations which is driven by the thermal stress produced by a temperature difference. In the temperature gradient LPE under a steady natural convection flow, there is a temperature difference across the thickness of the substrate. The temperature difference can cause a thermal shear stress in the fixed substrate. Thick GaAs and $Ga_{1-x}Al_xAs$ (x<0.3) layers were grown on (100) GaAs substrates. The estimated value of the thermal stress is slightly greater than the critical resolved shear stress for the formation of ⟨110⟩ oriented dark line defects. The observation of surface etch pits shows that the epitaxial layers have lower dislocation densities than that of the substrates or are even dislocation-free. (24 refs.)

71962 **A modified stress distribution for a subsonic moving dislocation.** K.Murayama, R.L.Thom, M.R.Lin, L.M.Angers, R.S.Herrick, S.H.Hong, D.E.Luzzi, Y.K.Park, D.R.Williams, M.S.Zedalis, J.Weertman (Dept. of Materials Sci. & Engng., Northwestern Univ., Evanston, IL, USA).
Mech. Mater. (Netherlands), vol.2, no.1, p.61-6 (April 1983).
In earlier moving edge dislocation theory the stresses across a slip plane are not continuous. A modification is proposed which corrects for this defect using smeared out dislocation theory at subsonic speed. Near the Rayleigh velocity, the smeared out subsonic dislocation theory is no longer applicable. The proposed modification may be extended for use in theory on earthquake faults. (2 refs.)

71963 **Semiconductor device technology and dislocation theory.** K.Sumino (Tokoku Univ., Sendai, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1246-54 (Nov. 1982). In Japanese. [received: March 1983]
The dislocation phenomena which occur in semiconductor elements including slip, and warp are described. In semiconductor crystal deformation the calculated and measured temperatures curves (800-950°C) for FZ silicon in a plot of shear v. warping are plotted. The relationship of dislocations with doping for FZ and CZ silicon is reviewed. (21 refs.) *M.O.*

71964 Dislocation motion in cellular structures. Y.Pomeau, S.Zaleski (Groupe de Phys. du Solide, Ecole Normale Superieure, Paris, France), P.Manneville.
Phys. Rev. A (USA), vol.27, no.5, p.2710-26 (May 1983).
The slow motions of cellular structures of parallel rolls are described by the amplitude equation in the weakly nonlinear domain. As this equation has a variational structure, the Peach-Kohler force exerted on a dislocation can be computed in the same way as for usual crystals. When the cellular structure is really described by variational equations, this force keeps its variational origin (it is the gradient of some energy) and vanishes for some optimal wave number. In thermoconvection in porous layers, this variational structure of the dynamics is lost at perturbative order beyond the one giving the usual amplitude equation. Therefore, the notion of an optimal wave number loses its meaning, and the quantity equivalent to the Peach-Kohler force does not vanish anymore at the wave number of marginal stability for perpendicular diffusion, contrary to what happens in variational systems where this condition defines the optimal structure. Another consequence of this nonvariational dynamics is the occurrence of gliding motion of dislocations in uniformly curved rolls, a situation where no Peach-Kohler force exists in variational systems. (14 refs.)

Microdefects in X-ray radiation detectors .... See Entry 70748

Investigation of changes in the grain-boundary structure as a result of recrystallization of a magnesium alloy after weak deformation .... See Entry 71972

Topographic characteristics of superplastic deformation of two-phase brass .... See Entry 72033

Spin-dependent recombination on dislocation dangling bonds in silicon .... See Entry 72425

Dislocation theory for long-term memory in stimulated electroacoustic-echo effect in powdered piezoelectrics .... See Entry 72454

Spin wave resonance in ferromagnets with dislocations forming a periodic layered structure .... See Entry 72678

Light scattering by decorated dislocations in alkali halide crystals .... See Entry 72819

The F centre near a charged dislocation .... See Entry 72837

Internal friction due to hysteretic dislocation motion in solid solution crystals .... See Entry 73123

Plastic deformation in the course of fracture of ferrite-pearlitic steels .... See Entry 73175

61.70J Etch pits, decoration, transmission electron-microscopy and other direct observations of dislocations

71965 Are the core structures of dislocations and grain boundaries resolvable by HREM?. A.Bourret, J.Thibault-Desseaux, C.D'Anterroches, J.M.Penisson, A.De Crecy (Dept. de Recherche Fondamentale, CENG, Grenoble, France).
J. Microsc. (GB), vol.129, pt.3, p.337-45 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
Linear or planar defect structures have been recently studied by high resolution electron microscopy (HREM). Defects are generally difficult to solve for several reasons: they are non-periodic and their images are limited to a very few projections along low index axes. For edge dislocations in materials having a high lattice friction, image analysis is possible and relatively fine details are now available about core radii and location of the atom pairs. The accuracy, however, of the proposed structures is within ±0.025 nm if a priori information is known. This is not always sufficient to distinguish between several models. For a high angle tilt grain boundary the situation is comparable. A discussion of the errors introduced by several factors (object orientation, optical axis alignment) and measurement of experimental parameters is presented. At present all the information content of an image is not used: intensity profiles and quantitative comparison of simulated and experimental images should provide better ways for solving an unknown structure. However, the improvement of the point resolution is the key factor for further progress in defect analysis. (17 refs.)

71966 Dislocation nucleation and precipitation of impurity in calcium-doped NaCl-KCl crystals. S.R.Ghadekar, B.T.Deshmukh (Dept. of Phys., Nagpur Univ., Nagpur, India).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.321-5 (9 May 1983).
In calcium-doped mixed NaCl-KCl crystals, Ca^{2+} ion sites were selectively sensed by a suitable etchant. Different impurity substructures, viz. arrays, close-networks, unevenly distributed clusters, were formed by the dopant ions in the lattice. Non-uniform distributions of the impurity ions in the lattice does not nucleate dislocations. Non-structural impurities like precipitates were found to take different forms, viz. elongated rods, rectangular forms, with different orientations. Dislocations showed strong preference for the nucleation of the precipitates. The nucleation of the precipitates at sites other than those of dislocations is discussed. (28 refs.)

71967 Structural changes in nickel after ultrasonic action with subthreshold amplitudes in liquid helium. V.K.Aksenov, O.I.Volchok (Physicotech. Inst., Acad. of Sci., Khar'kov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1769-70 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3125-8 (Oct. 1982). [received: April 1983]
The authors present data from investigations on the dislocation structure and the yield point $\sigma_{0.2}$ of nickel after acoustic irradiation in liquid helium, in liquid nitrogen, and at room temperature. Measurements are made using electron microscopy. (12 refs.)

Reduction of dislocations in LPE layers due to the action of thermal stresses .... See Entry 71961

High resolution and conventional electron microscopy studies of repeated wedge microtwins in monoclinic rare earth sesquioxides .... See Entry 71974

Dislocation behavior in the vicinity of grain boundaries in FCC metals and alloys .... See Entry 71977

Si implantation in GaAs .... See Entry 71994

Transmission electron microscopic observation of precipitates in Si^+ ion-implanted GaAs .... See Entry 71995

The interaction between point defects introduced by implantation and dislocations in silicon .... See Entry 72002

A simple, high collection efficiency cathodoluminescence imaging technique: application to GaSb and CdTe .... See Entry 72875

Observation of defects in mercury cadmium telluride crystals grown by chemical vapor transport .... See Entry 72975

Effect of zinc content on the annealing behaviour of deformed alpha-brasses .... See Entry 73106

Transmission electron microscopy of an annealed and nitrided Fe-600 wt.ppm Ti alloy .... See Entry 73116

Deformation behavior of blended elemental Ti-6Al-4V compacts .... See Entry 73152

The interaction of dislocation with Θ'-precipitates in a Al-2.8% Cu-alloy during fatigue tests .... See Entry 73215

Damage during friction and dislocation structure of gold-platinum solid solutions .... See Entry 73219

61.70L Slip, creep, internal friction and other indirect evidence of dislocations

(see also 62.20H Creep, 62.40 Internal friction)

71968 Theoretical latent hardening of crystals in double-slip. II. FCC crystals slipping on distinct planes. K.S.Havner (Dept. of Civil Engng., North Carolina State Univ., Raleigh, NC, USA), S.A.Salpekar.
J. Mech. & Phys. Solids (GB), vol.31, no.3, p.231-50 (1983).
For pt.I see ibid., vol.30, p.379 (1982). The line of investigation of theoretical latent hardening in axially-loaded cubic crystals initiated by K.S. Havner and A.H. Shalaby (1977), based upon their 'simple theory' of rotation-dependent crystal anisotropy (and continued through various other works), is completed with the analysis of finite double-slip on distinct planes in FCC crystal lattices. In conjunction with a previous study by the present authors of double-slip on a common plane (Havner and Salpekar, 1982), the general theoretical result is that any FCC crystal which initially deforms homogeneously from the virgin state in double-slip, under either tensile or compressive axial loading, will continue in that mode of deformation to very large shears ($\gamma=1.5$ and beyond). A comparative review of various hardening rules (including the 'simple theory') with regard to both theoretical predictions and mathematical issues is included and may be found instructive. (17 refs.)

Chaotic flow in a model for repeated yielding .... See Entry 71404

Reduction of dislocations in LPE layers due to the action of thermal stresses .... See Entry 71961

Dislocation behavior in the vicinity of grain boundaries in FCC metals and alloys .... See Entry 71977

A micromechanical theory of grain-size dependence in metal plasticity .... See Entry 72034

Excited triplet states and optical polarization of nuclear magnetic moments in semiconductors .... See Entry 72702

Cyclic stress relaxation of polycrystalline metals at elevated temperature .... See Entry 73122

Internal friction due to hysteretic dislocation motion in solid solution crystals .... See Entry 73123

S-N curve inversion of nickel-base superalloy at elevated temperature .... See Entry 73203

The interaction of dislocation with Θ'-precipitates in a Al-2.8% Cu-alloy during fatigue tests .... See Entry 73215

Subsurface hardening in erosion-damaged copper as inferred from the dislocation cell structure, and its dependence on particle velocity and angle of impact .... See Entry 73232

61.70N Grain and twin boundaries

71969 Effects of rigid grain separation on the diffusive growth of crack-like cavities on grain boundaries. T.-L.Sham (Div. of Engng., Brown Univ., Providence, RI, USA).
Mech. Mater. (Netherlands), vol.2, no.1, p.9-18 (April 1983).
Previous analyses of diffusive growth of grain boundary cavities in the limiting case of a crack-like mode under the rigid grain assumption have assumed that the effect of grains separation rate on the cavity growth rate is negligible. This is more valid when the cavity growth rates are very high. Here, the author investigates the validity of this assumption at lower cavity growth rates by incorporating the contribution of the rigid grains separation rate in the analysis. The resulting geometry of the crack-like cavity near its tip is given. This information is used to set boundary conditions for the rigid grain model. Numerical results for the applied stress versus the cavity growth rate are presented. They are compared with those given by Chuang, Kagawa, Rice and Sills (1979), whose analysis assumes the rate of separation of the grains to be small compared to the cavity growth rate. Comparison with the results of Chuang et al. (1979) for the rupture time based on cavity growth to coalescence is also made. (9 refs.)

71970 Evidence for the isomorphism of the low-temperature form of hexaamminecobalt(III) iodide with the room-temperature structure of hexaamminecobalt(III) chloride. T.R.Welberry, B.E.Williamson (Res. School of Chem., Australian Nat. Univ., Canberra, Australia).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.5, p.513-14 (15 May 1983).
Crystals of $[Co(NH_3)_6]I_3$ which are cubic at room temperature become polydomained on cooling below 280K. The authors show that oscillation photographs taken below the transition may be indexed on the assumption that 12 twinned orientations of a monoclinic cell are present in the crystal. With the adoption of this new cell, the powder data of Borzecka et al. [Acta Phys. Pol.A (1980)] have been reinterpreted to yield: $a=13.44$ (2), $b=23.02$ (3), $c=13.37$ (2) Å, $\beta=110.69$ (7)°. (22 refs.)

71971 Structure and properties of chromomanganese austenitic steels hardened by hydraulic extrusion. G.A.Pegushina, V.A.Teplov (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.538-42 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the structure of 60G12Kh9F2 steel after hardening by hydraulic extrusion and rolling. When the degree of deformation was high, characteristic noncoherent twin bands formed in the extruded material. The orientations of the crystal lattices in these twins differed from that expected. (9 refs.) *A.T.*

71972 Investigation of changes in the grain-boundary structure as a result of recrystallization of a magnesium alloy after weak deformation. R.Z.Valiev, V.Yu.Gertsman, O.A.Kaibyshev (Ordzhonikidze Aviation Inst., Ufa, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.554-8 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A correlation was established between the behaviour of defects formed in grain boundaries as a result of capture of lattice dislocations in the course of plastic deformation and the changes in the microstructure of weakly deformed samples of alloy MA8 during annealing. The deformation defects, which

determined the grain-boundary structure, also played an important role in the process of recrystallization after weak deformation. (17 refs.) *A.T.*

71973 Crystallogeometric features of the subgrain structure and their relationship to the deformation texture. A.N.Vergazov, V.V.Rybin, Yu.F.Titovets.
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.559-70 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Experimental studies were made of the distributions of orientations and relative misorientations of subgrains in molybdenum. The results were analyzed from the point of view of the mechanism of formation of the subgrain structure and the origin of deformation textures. (13 refs.) *A.T.*

71974 High resolution and conventional electron microscopy studies of repeated wedge microtwins in monoclinic rare earth sesquioxides. C.Boulesteix (Lab. de Microscopie Electronique Appliquee, Marseille, France), B.Yangui, G.Nihoul, A.Bourret.
J. Microsc. (GB), vol.129, pt.3, p.315-26 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
High resolution and conventional studies have been made on the inclined twin boundaries occurring near the tip of wedge microtwins in the case of repeated wedge microtwins occurring at twin intersections. These inclined boundaries appear to be continuous and all the atomic planes are also continuous so that it is suggested that the use of the term 'inclined coherent boundaries' instead of 'incoherent' which one generally employs, in analogy to the case of precipitates in a matrix. This is different from what occurs in the case of isolated wedge microtwins for the same material and for the same kind of twins where the inclined twin boundary is really not coherent, being made of non-inclined coherent regions separated by steps containing a dislocation. A comparative study of the different roles related to the different structures of inclined twin boundaries for isolated and repeated wedge microtwins has been made, and also a comparative study of the mechanism of stress relaxation to each case. The studies have been made on (313) twins of a monoclinic samarium sesquioxide. (17 refs.)

71975 Determination of grain boundary rotation parameters from Kikuchi patterns. II. Experimental optimization of the analysis of grain boundary orientation relationships and verification of the accuracy of the proposed method. H.O.Martikainen (Dept. of Mining & Metall., Helsinki Univ. of Technol., Espoo, Finland), V.K.Lindroos.
Phys. Status Solidi a (Germany), vol.76, no.2, p.709-19 (16 April 1983).
For pt.I see ibid., vol.75, p.559 (1983). The use of an advanced electron optical method for the experimental determination of grain boundary orientation relationships is demonstrated in connection with the study of structural BCC steel after large degree of high temperature deformation. Furthermore, the accuracy of the analytical method proposed in Part I is experimentally verified using two different approaches based on (1) the tilting of the foil and on (2) the multiplication test using rotation matrices of three grain boundaries of a triple junction. (10 refs.)

71976 On calculated energies of segregation, grain boundary energies and lattice energy functions. J.T.Wetzel, E.S.Machlin (Henry Krumb School of Mines, Columbia Univ., New York, NY, USA).
Scr. Metall. (USA), vol.17, no.4, p.555-8 (April 1983).
Values of the energy of segregation provided by computer simulation of grain boundary segregation are higher than those obtained using published values of the solute enhancement factor at grain boundaries. It is suggested that the discrepancy is caused by the lattice energy functions used for the calculations. A new lattice energy function gives better agreement between calculated and observed results when applied to (210)/[001] tilt grain boundaries of the metals Au, Cu, Ni and Pb. (10 refs.)

71977 Dislocation behavior in the vicinity of grain boundaries in FCC metals and alloys. H.Fujita (Dept. of Materials Sci. & Engng., Osaka Univ., Osaka, Japan), K.Toyoda, T.Mori, T.Tabata, T.Ono, T.Takeda.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.195-204 (April 1983).
Dislocation behavior in the vicinity of grain boundaries has been investigated by in situ deformation with a 3 MeV electron microscope in bicrystals of aluminum, copper and copper-aluminum alloys. The dislocations in a Cu-5 wt.% Al alloy can move through the boundary with misfit angle 5° at some parts where the dislocations pile up two-dimensionally when the tensile axis is perpendicular to the tilt boundary. When the stacking fault energy and the misfit angle of boundary increase, the dislocations become hardly possible to move through the boundary. Three-dimensional pile-up of the dislocations heavily occurs against the boundary in a crystal, whose Schmid factor is larger than the other, when the tensile axis is perpendicular to the boundary. The dislocation tangles, however, are formed in another crystal. Many slip systems are operated in the vicinity of the boundary and the dislocation tangles are easily formed in both crystals when the tensile axis is parallel to the boundary. Recrystallization easily occurs in regions near the boundary when the specimens are stretched along the boundary. (20 refs.)

71978 Landau theory of periodic antiphase boundaries in CuAu alloys. W.L.McMillan (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.111-14
A Landau theory is developed to discuss properties of periodic antiphase boundaries in CuAu alloys. The properties of the modulated phase are calculated. (6 refs.)

The use of moire techniques to measure rigid body displacements .... See Entry 71845

Are the core structures of dislocations and grain boundaries resolvable by HREM? .... See Entry 71965

Argon implantation in GaAs: damage and lattice site location analyses .... See Entry 71992

Si implantation in GaAs .... See Entry 71994

A micromechanical theory of grain-size dependence in metal plasticity .... See Entry 72034

Multiplicity of causes of grain-boundary fracture .... See Entry 72039

Melting and crystallisation on a corrugated surface .... See Entry 72083

Interaction of impurities with grain boundaries in austenite .... See Entry 72117

Sodium deposition in fast ion conductors .... See Entry 72152

Epitaxial regrowth of Si implanted (100) and (211) GaAs .... See Entry 72272

Some aspects of micro-alloying .... See Entry 73092

Role of grain boundary segregation in diffusional creep .... See Entry 73144

The effects of segregation on the kinetics of intergranular cavity growth under creep conditions .... See Entry 73146

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures .... See Entry 73147

Deformation behavior of blended elemental Ti-6Al-4V compacts .... See Entry 73152

High temperature embrittlement of Ni and Ni-Cr alloys by trace elements .... See Entry 73198

The enhancement of hydrogen attack in steel by prior deformation .... See Entry 73200

Crack propagation of high strength steels in a gaseous hydrogen atmosphere .... See Entry 73202

The role of oxide grain boundaries in the development of growth stresses during oxidation .... See Entry 73259

Sensitization of austenitic stainless steels. II. Commercial purity alloys .... See Entry 73264

A scanning electron microscopic study of winged twin crystals in the bean legume .... See Entry 73524

61.70P Stacking faults, stacking fault tetrahedra and other planar or extended defects

71979 Shear band interactions with crystals in partially crystallised metallic glasses. P.E.Donovan, W.M.Stobbs (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.61-76 (April 1983).
The morphology of shear bands in two partially crystallised metallic glasses, $Ni_{80}B_{20}$ and $Cu_{50}Zr_{50}$, is deduced by transmission and scanning electron microscopy. A number of different types of crystal/shear band interaction have been characterised, providing evidence both for the dilatational model of shear band deformation and for long range interactions between an operating shear band and a stress raiser in the amorphous matrix. Qualitative differences in the mechanical properties of the two partially crystallised glasses examined are rationalised in terms of the interactions observed. (22 refs.)

71980 An investigation of order/disorder in a chromia-doped rutile by high-resolution electron microscopy. G.J.Wood (High Resolution Electron Microscope, Univ. of Cambridge, Cambridge, England), L.A.Bursill, D.J.Smith.
J. Microsc. (GB), vol.129, pt.3, p.263-73 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
Computer image simulations predict that the detailed atomic arrangements along extended CS defects in slightly-reduced rutile may be identified in 500 kV high-resolution electron micrographs. Experimental images from a chromia-doped rutile have generally confirmed these predictions although also indicating that considerable disorder remains. The need for very careful control of sample preparation, including heat treatments, is emphasized. (21 refs.)

71981 The high resolution electron microscopy of stacking defects in Cu-Zn-Al shape memory alloy. J.M.Cook (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England), M.A.O'Keefe, D.J.Smith, W.M.Stobbs.
J. Microsc. (GB), vol.129, pt.3, p.295-306 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
The characteristic defects in the martensitic phase of the memory alloy Cu-Zn-Al have been investigated using the Cambridge University 600 kV High Resolution Electron Microscope. Conditions are found under which the images can be quantitatively simulated when this involves the transfer of structural information at resolutions beyond the first zero of the contrast transfer function. Defects of sequence-type were positively identified by the comparison of high-resolution micrographs with full dynamical image simulations. (12 refs.)

71982 Microstructure of Sm_5Ni_{19} intermetallic compound observed by high-resolution electron microscope. S.Takeda, H.Horikoshi, Y.Komura (Dept. of Materials Sci., Hiroshima Univ., Hiroshima, Japan).
J. Microsc. (GB), vol.129, pt.3, p.347-58 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
The method of high-resolution electron microscopy is applied to study the microstructure of the Sm-Ni intermetallic compound whose composition is near Sm_5Ni_{19}. Several new polytypic structures (5 T, 7 T, 15 R and 18 R) are found and their crystal structures are analysed by high-resolution imaging combined with electron diffraction. Various kinds of defects are observed and the atomic arrangements near the defects are deduced; the defects include stacking faults in Sm_5Ni_{19}, complicated defect structure which changes the stacking sequence of Sm_5Ni_{19}, and lattice defects in the region of terminating the intergrowth. (14 refs.)

Direct measurement of the melt depth of silicon during laser irradiation .... See Entry 72005

A transformation anomaly in a Cu-Zn-Al alloy .... See Entry 73083

61.70R Crystal impurities: general

(see also 71.55 Impurity and defect levels; 81.10 Purification techniques)

71983 Direct evidence for the site of substitutional carbon in GaAs using localised vibrational mode spectroscopy. W.M.Theis (Univ. Res. Center, Wright State Univ., Dayton, OH, USA), K.K.Bajaj, C.W.Litton, W.G.Spitzer.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.166-18 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
High resolution transmission measurements using Fourier transform infrared spectroscopy of the localized vibrational mode (LVM) due to substitutional carbon in GaAs provide direct evidence that the carbon resides predominantly on the As sublattice (C_{As}). These spectra are found to be the near superposition of at least four bands which may be fit to a combination of Lorentzian functions. The LVM produced by Si_{As} and GaAs exhibits similar structure which also may be fitted by Lorentzians. The only satisfactory explanation is that these spectral features arise from shifts due to different nearest neighbor configurations of the two GaAs isotopes. There is no experimental indication of C_{Ga}. In addition, the full widths at half maximum of these bands are much smaller than previously believed. (13 refs.)

71984 Tendency to nearly cubic local lattice structure around interstitial hydrogen in the alkali metals. G.Solt (Inst. de Phys., Neuchatel Univ., Neuchatel, Switzerland), M.Manninen, H.Beck.
Solid State Commun. (USA), vol.46, no.4, p.295-8 (April 1983).
The behaviour of the lattice response in the BCC alkali metals and the change in sign of the impurity-host interaction between first and second neighbour distances are shown to cooperate to build up a relaxed atomic environment which, for the D_{4h} 'octahedral' interstitial position, is close to a

regular octahedral coordination. The calculation is done by using the self-consistent electron density for a proton in jellium to take into account non-linear screening, and the relaxed crystal structure is found by the method of lattice statics. The displacements around the hydrogen impurity are found to be many time larger than those predicted earlier by use of the spherical solid model. (14 refs.)

On the temperature of phase dissolution in real crystals ....See Entry 72115

ESR of Fe^{3+} centers in Na$_3$H(SO$_4$)$_2$ crystals ....See Entry 72667

Application of optical polarization of nuclear moments and of NMR to the study of the physical properties of doped semiconducting materials ....See Entry 72701

Impurities in polycrystalline silicon solar cells ....See Entry 73454

61.70T Doping and implantation of impurities

71985 Suppressing Al outdiffusion in implantation amorphized and recrystallized silicon on sapphire films. R.E.Reedy (Naval Ocean Systems Center, San Diego, CA, USA), T.W.Sigmon, L.A.Christel.
Appl. Phys. Lett. (USA), vol.42, no.8, p.707-9 (15 April 1983).
In this work the authors have used a dual implant and anneal process to significantly improve the crystalline quality of 0.3-μm silicon on sapphire films while simultaneously minimizing the outdiffusion of free Al from the sapphire into the Si layer. The crystalline quality, as measured by MeV ^{4}He$^+$ ion channeling closely approached $\langle 100\rangle$ bulk Si values and the Al concentration, as measured by secondary ion mass spectrometry, was less than 3×10^{15} cm^{-3}. An explanation for why similar techniques result in large amounts of aluminum outdiffusion when applied to 0.5-μ films is proposed. (7 refs.)

71986 Effect of argon implantation on the activation of boron implanted in silicon. A.Milgram, M.Delfino (Fairchild Advanced Res. & Dev. Lab., Palo Alto, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.878-80 (15 May 1983).
Argon ions were implanted either prior or subsequent to an ion implantation of boron into silicon wafers. After isochronal annealing at temperatures ranging from 500 to 900°C, the samples were examined by a spreading resistance-carrier concentration profile and secondary ion mass spectroscopy. It is shown that argon implantation at a dose sufficient to produce an amorphous layer inhibits the electrical activation and diffusion of boron implanted in silicon. (12 refs.)

71987 Specific site location of S and Si in ion-implanted GaAs. R.S.Bhattacharya, P.P.Pronko (Universal Energy Systems Inc., Dayton, OH, USA), S.C.Ling.
Appl. Phys. Lett. (USA), vol.42, no.10, p.880-2 (15 May 1983).
Rutherford backscattering and proton induced X-ray emission in combination with channeling have been used to investigate the specific site location of S and Si implanted in GaAs through the asymmetry in their channeling dips. A pronounced asymmetry is observed for $\langle 110\rangle$ scans parallel to the $\{110\}$ plane in the case of S, whereas no such asymmetry is found for the case of Si. These results clearly indicate that S predominantly occupies one sublattice site which is shown to be the As site whereas Si occupies both Ga and As sites in about equal concentrations. (11 refs.)

71988 Calculation of ion project range on amorphous targets of ternary and quarternary alloys. Wang De-ning, Guo Hu-ling, Wnag Wei-yuan (Shanghai Inst. of Metall., Acad. Sinica, Shanghai, China).
Acta Phys. Sin: (China), vol.32, no.3, p.393-9 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The authors have calculated the project range for ions on amorphous targets made of ternary or quarternary alloys. Their calculations are based upon Vagard's law, which establishes that the project range in multi-component system can be obtained by linear combination of those of its composing binary alloy compounds. The calculated project ranges of systems H$^+\rightarrow$GaAlAs, InAs and InGaAs, Be$^+\rightarrow$GaInSb and InAsSb, and B$^+\rightarrow$Hg$_{0.8}$Cd$_{0.2}$Te, agree well with the experimental or calculated results published in literatures. The dependences of project range on implantation energy and composition in the processes H$^+\rightarrow$GaInAsP and GaAlAsSb, and ions$\rightarrow$PbSnTe are also calculated. (12 refs.)

71989 High-dosage implantation of oxygen into surface layers of Si and SiO$_2$. G.F.Romanova, P.I.Didenko, R.I.Marchenko.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.23-8 (1982). In Russian.
The profiles of high-dosage oxygen implantation into silicon and layers of silicon dioxide are studied by secondary ion mass spectrometry. The formation of SiO$_2$ during the implantation of ^{16}O$^+$ into Si is found to start from a dosage of 10^{17} ion. cm^{-2}, initially in the form not of a continuous layer but of individual impregnations of SiO$_2$ in amorphised Si. At doses of 10^{18} ion. cm^{-2} a continuous layer of SiO$_2$ with a clearly marked Si-SiO$_2$ boundary emerges on the silicon surface. Implantation of ^{16}O$^+$ into thermal SiO$_2$ causes changes in the structure of the oxide. Mechanisms for the interaction of ^{16}O$^+$ with Si and in SiO$_2$ are discussed. (15 refs.) *L.M.H.*

71990 Limiting doses for ion doping of metals. N.V.Makarets, G.L.Fal'ko, A.M.Fedorchenko (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.421-5 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A theoretical study is made of the accumulation of impurities resulting from high-fluence high-temperature ion implantation of impurities in metals subject to an allowance for the sputtering of the target surface. The limiting dose of the remaining impurity is found and its dependence on the ion energy and temperature are determined. For energies of the order of tens of kiloelectron-volts the limiting dose is very small. This dose can be increased considerably by increasing the target temperature. (5 refs.) *A.T.*

71991 Helium reemission during implantation of silicon carbide. S.Miyagawa, Y.Ato, Y.Miyagawa (Government Industrial Res. Inst., Nagoya, Japan).
J. Appl. Phys. (USA), vol.54, no.5, p.2302-6 (May 1983).
Reemission has been measured during implantation of 1 keV and 20 keV helium ions in CVD SiC at room temperature and at 600°C. The reemission behavior depends strongly on target temperature as well as ion energy, and there exists a close relationship between the reemission behavior and surface features. The flaking of CVD SiC is explained by crack propagation through the implanted layer, with gas pressure being the driving force for cracking. The effects on the reemission behavior of prebombardment with helium ions having continuous energy distribution distribution have been also measured. (16 refs.)

71992 Argon implantation in GaAs: damage and lattice site location analyses. A.K.Rai, R.S.Bhattacharya, P.P.Pronko (Universal Energy Systems Inc., Dayton, OH, USA), S.C.Ling.
J. Appl. Phys. (USA), vol.54, no.5, p.2307-11 (May 1983).
The recrystallization behavior of Ar$^+$implanted GaAs has been studied using transmission electron microscopy and Rutherford backscattering channeling and proton induced X-ray emission techniques. Ar$^+$ implanted in undoped GaAs at 700 keV to a fluence of 5×10^{15} cm^{-2} has been used in the present investigation. Formation of microtwins are observed after annealing at 400°C. These microtwins start to anneal at about 600°C and disappear completely at about 850°C at which point Ar bubbles are observed to form along with dislocations. Lattice location experiments show that the Ar atoms are randomly distributed in the lattice. (12 refs.)

71993 The nature of defect layer formation for arsenic ion implantation. S.Prussin, D.I.Margolese, R.N.Tauber (TRW Electronics Systems Group, Redondo Beach, CA, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2316-26 (May 1983).
A series of $\{100\}$ silicon wafers were implanted with As ions over the range of 1×10^{13} at. cm^{-2} to 1×10^{16} at. cm^{-2} with energies of 50, 100, and 190 keV, using a commercial ion implanter, the Varian 200-DF4. Two end stations were used, the Waycool which provided good contact between the wafers and a thermal sink and the Wayflow, which holds the wafers without any provision for obtaining such contact. Precise values of amorphous layer depth were obtained by a newly developed technique, using direct measurement of the depth exposed by a tapered groove. For the Waycool implanted wafers, the amorphous layer depth increased with dose. For the Wayflow wafers, the amorphous layer depth increased to a maximum and then decreased, finally disappearing at the higher doses. Combining shallow angle-lapping, etching, and profilometry, it was possible to study the submerged amorphous layers originating at the threshold dose for the 190-keV implantations. For Waycool implanted wafers, the surface crystalline layer thickness decreased and disappeared with increased dose. For Wayflow wafers, the surface crystalline layer increased with dose, meeting the crystalline substrate which grew from the opposite direction. The differences in defect structure between Waycool and Wayflow implanted wafers are attributed to the dynamic annealing which occurs during implantatiuon. The defects remaining after a low temperature transformation anneal are correlated to dynamic annealing effects. (28 refs.)

71994 Si implantation in GaAs. R.S.Bhattacharya, A.K.Rai, Y.K.Yeo, P.P.Pronko (Universal Energy Systems Inc., Dayton, OH, USA), S.C.Ling, S.R.Wilson, Y.S.Park.
J. Appl. Phys. (USA), vol.54, no.5, p.2329-37 (May 1983).
High-resolution Rutherford backscattering, transmission electron microscopy, and proton-induced X-ray emission with channeling have been used to investigate the damage and lattice site location of Si-implanted GaAs. Semi-insulating Cr-doped GaAs(100) crystals were implanted at room temperature with Si$^+$ ions of single (120 keV) and multiple energies (50-400 keV). The total dose of implanted ions varies from 3×10^{15} cm^{-2} to 5×10^{15} cm^{-2}. The residual damage and the lattice location of the implant are determined after 15 min annealing of the samples at 850°C and 950°C in addition to the usual dislocation loops. However, after annealing at 950°C, the primary residual damage consists of dislocation loops in addition to some small precipitates. Electrical activation efficiency has been measured in the case of 3×10^{15} cm^{-2} implant and found to be very low ($\leq$2%). Si$_{Ga}$-Si$_{As}$ neutral pair association is suggested to be the most probable reason for low electrical activity. (7 refs.)

71995 Transmission electron microscopic observation of precipitates in Si$^+$ ion-implanted GaAs. G.Das (Systems Res. Labs. Inc., Dayton, OH, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.969-70 (April 1983).
Radiation damage in the form of dislocation loops and an amorphous layer was observed in Si$^+$ ion-implanted GaAs by transmission electron microscopy (TEM) and reflection electron diffraction. Precipitates in heavily Si$^+$ ion-implanted GaAs were observed at room temperature. These precipitates are matched with those of SiAs$_2$. (3 refs.)

71996 Ion-implantation associated defect production in silicon. J.R.Troxell (Electronics Dept., General Motors Tech. Center, Warren, MI, USA).
Solid-State Electron. (GB), vol.26, no.6, p.539-48 (June 1983).
Defects produced during ion implantation have traditionally been removed during high temperature ($\geq$1200K) thermal processing. The current industry trend towards lower temperature processing will require new techniques for suppressing defect formation associated with ion implantation. This paper details the characterization and identification of the electrically active defects which are produced during low dose ion implantation. Several of the observed defect levels can be correlated with defects which have been identified in electron irradiated silicon. However, a defect level near mid gap, $H(0.53)$, which should be the dominant recombination center in p-type samples, cannot be correlated with previously identified defects. Similarly, the $H(0.20)$ level is found to anneal near 420K, and thus does not correlate well with the known properties of the divacancy, which introduces a similar trapping level. (58 refs.)

71997 Ion implantation process modelling. G.Drozdy, T.Lohner, P.Revesz, K.Tarnay, J.Gyulai (Central Res. Inst. for Phys., Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.125-8 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
A simulation program for implantation (IMPLAN) has been developed as part of a complete silicon planar technology simulation program (STEP, Silicon Technology Evaluation Program). The input parameters of IMPLAN are the type of implanted ions, the target material, the kind of the eventual covering surface layer and its thickness, the energy of the ion implantation and the dose. The output is the dopant profile in numerical or graphical format. Joined half-Gaussian and Pearson distributions are used in the program in order to get high accuracy. To measure implanted depth profiles, the authors used a high resolution Rutherford backscattering (RBS) technique. Comparison of the experimental results and simulations shows that the difference between theory and experiment is mostly less than the errors of the measurements. (8 refs.)

Semiconductor device technology and dislocation theory ....See Entry 71963

Gettering of oxygen in Si wafers damaged by ion implantation and mechanical abrasion ....See Entry 71998

PL/1 program computes dopant concentration ....See Entry 71999

The interaction between point defects introduced by implantation and dislocations in silicon ....See Entry 72002

CW CO$_2$-laser annealing and alloying of semiconductors ....See Entry 72013

Substrate heating effects in CO_2 laser annealing of ion-implanted silicon .... See Entry 72014

Annealing of implantation defects in silicon through a quickly deflected electron probe .... See Entry 72017

Heat of crystallization and melting point of amorphous silicon .... See Entry 72081

Precipitation as the phenomenon responsible for the electrically inactive arsenic in silicon .... See Entry 72119

Electrical properties of Te diffused silicon .... See Entry 72164

The effect of implantation of phosphorus into sputtered $MoSi_2$ thin films .... See Entry 72258

Growth and characterization of Si doped vapor phase epitaxial GaAs for MESFET .... See Entry 72265

Epitaxial regrowth of Si implanted (100) and (211) GaAs .... See Entry 72272

The resistivity inhomogeneity and the maximum possible mean resistivity of neutron-transmutation doped silicon .... See Entry 72389

Influence of backside argon implantation on the Si-SiO_2 interface .... See Entry 72511

Characteristics of formation and annealing of defects in silicon near the Si-SiO_2 interface during implantation of Ar^+ions .... See Entry 72512

An overview of ion sputtering physics and practical implications .... See Entry 72916

Electrochemical etching of copper ion implanted H-19 aluminum in aqueous chloride/sulfate solution at 95 C .... See Entry 73266

^{252}Cf plasma desorption in ion implanted mica .... See Entry 73389

61.70W Impurity concentration, distribution, and gradients

(see also 66.30J Diffusion, migration and displacement of impurities)

71998 Gettering of oxygen in Si wafers damaged by ion implantation and mechanical abrasion. J.C.Mikkelsen,Jr. (Xerox Palo Alto Res. Centers, Palo Alto, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.695-7 (15 April 1983).
Isotopic substitution of ^{18}O was used in conjunction with secondary ion mass spectrometry to distinguish the source of gettered oxygen associated with damage produced in Si wafers by As ion implantation and by mechanical abrasion. It was found that oxygen was gettered from annealing ambients, exhibiting an enhanced diffusivity in the vicinity of the damaged layers at 600°C. On the contrary, the oxygen originally dissolved in the wafers was unaffected by the damage, not being gettered by either type of damage and having the same diffusivity as that in undamaged Si crystals. These results are compared with published reports of ^{16}O analysis of similar experiments. (16 refs.)

71999 PL/1 program computes dopant concentration. J.Setian.
Electronics (USA), vol.56, no.7, p.167-9 (7 April 1983).
Presents a PL/1 program which computes the dopant concentration in a silicon wafer for both the predeposition and drive-in steps. The first step computes predeposition values and gives the precise amount of impurity that should be introduced into the crystal lattice of the wafer. Then the drive-in operation provides the final junction depth and impurity profile. (1 ref.)

72000 A correlation of atomic and electrical measurements of Cr and residual donors in thermally processed semi-insulating GaAs. P.K.Vasudev, R.G.Wilson (Hughes Res. Labs., Malibu, CA, USA), C.A.Evans,Jr., V.R.Deline.
Solid-State Electron. (GB), vol.26, no.6, p.565-7 (June 1983).
Chromium redistribution resulting in residual donor decompensation has been proposed to explain near-surface type-conversion in furnace-annealed, semi-insulating GaAs. The authors report correlations of Cr depth profiles and residual donor atom densities determined by SIMS with Hall effect and C-V electrical measurements of carrier densities which substantiate the above hypothesis. Furthermore, a 1:1 Cr-to-donor compensation ratio is observed for Cr doping levels of $\sim 10^{17}$ cm^{-3}. (9 refs.)

72001 Problem of behavior of oxygen in Si. G.Vakilova, R.F.Vitman, A.A.Lebedev, S.Mukhammedov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1426-7 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2204-7 (Dec. 1982). [received: May 1983]
The authors have studied the oxygen concentration and diffusion in Si using IR absorption spectra. They present results on the effects of high-temperature treatment on the electrical resistance. (20 refs.)

High-dosage implantation of oxygen into surface layers of Si and SiO_2 .... See Entry 71989

Limiting doses for ion doping of metals .... See Entry 71990

Electrical properties of Te diffused silicon .... See Entry 72164

Vapor phase epitaxial growth of ZnSe films .... See Entry 72263

Growth and characterization of Si doped vapor phase epitaxial GaAs for MESFET .... See Entry 72265

Changes in the optical properties of oxygen in silicon as a result of heat treatment and irradiation .... See Entry 72813

A new conversion coefficient for oxygen content. Determination in Si by IR absorption .... See Entry 72840

Recent progress in characterisation techniques. Development and standardisation of new techniques .... See Entry 72856

Cathodoluminescence of anodically grown SiO_2 films .... See Entry 72874

Use of secondary ion emission for investigating the distribution profiles of elements and compounds in various film compositions .... See Entry 73382

61.70Y Interaction between different crystal structure defects

72002 The interaction between point defects introduced by implantation and dislocations in silicon. V.V.Kalinin, N.N.Gerasimenko (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.65-70 (16 March 1983).
Defects appearing after boron and phosphorus ion implantation and annealing at 760°C in Si specimens having no 'primary' imperfections and having misfit dislocation networks as well as dislocation loops, are studied. Perfect specimens form characteristic rod-like defects (RDs). In specimens having 'primary' dislocations generated by a prior boron ion implantation and high-temperature annealing the number and sizes of RDs is considerably lower. If primary dislocations were generated by a prior phosphorus ion implantation, then, instead of RDs, a great number of dislocation loops of interstitial type are formed in their vicinity. Possible causes of the influence of the dislocation type upon the nature of the dislocation-point defect interaction are discussed. (16 refs.)

72003 Interaction of radiation defects with iron impurities in GaAs crystals. V.V.Teslenko, E.Yu.Brailovskii, I.D.Konozenko, N.Kh.Pambukhchyan (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1422-3 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2199-201 (Dec. 1982). [received: May 1983]
The authors have determined the ESR spectra of GaAs:Fe in order to study the processes of the interaction between radiation defects and iron atoms during electron irradiation and in the course of subsequent annealing. (8 refs.)

ESR study on impurity-vacancy aggregation in Eu^{2+} doped and (Eu^{2+}, M^{2+}) doped KCl .... See Entry 72669

Light scattering by decorated dislocations in alkali halide crystals .... See Entry 72819

Effects of hydrogen on near-threshold crack propagation in niobium .... See Entry 73201

61.80 RADIATION DAMAGE AND OTHER IRRADIATION EFFECTS

(for techniques of structure determination, see 61.10 to 61.16; for electron and ion impact phenomena, see 79.20)

72004 Crystals containing a high density of lattice defects after heavy irradiation. R.Hasiguti (Sci. Univ. of Tokyo, Tokyo, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1290-2 (Nov. 1982). In Japanese. [received: March 1983]
Lattice defects in crystals (10^{-3}-10^{-1}) of materials used in nuclear fusion reactor inner walls are examined. The history of the irradiation of the materials is recounted before showing cascade, complex cascade, defect movement, displacement causing absorption and void formation. A TEM study of voids in aluminium is discussed. (2 refs.) *M.O.*

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management .... See Entry 69789

A study of certain properties of bitumen compounds which determine the conditions for their storage .... See Entry 70680

Excited triplet states and optical polarization of nuclear magnetic moments in semiconductors .... See Entry 72702

Regenerated thermoluminescence .... See Entry 72877

An overview of ion sputtering physics and practical implications .... See Entry 72916

^{252}Cf plasma desorption in ion implanted mica .... See Entry 73389

61.80B Laser beams

72005 Direct measurement of the melt depth of silicon during laser irradiation. Y.Hayafuji, Y.Aoki, S.Usui (SONY Corp. Res. Center, Yokohama, Japan).
Appl. Phys. Lett. (USA), vol.42, no.8, p.720-2 (15 April 1983).
The authors have studied the change in morphology of laser irradiated silicon wafers by annihilating the oxygen thermal donors and the oxidation-induced stacking faults in order to verify the melting of the near-surface regions. The laser beam used was of 1.06 μm with a diameter of 40 μm, generated from a *Q*-switched neodymium:yttrium aluminum garnet (Nd:YAG) laser with a 150-ns pulse width and at a repetition rate of 12 kHz. Laser beam irradiation above about 6 J/cm^2 annihilated both thermal donors and stacking faults, giving evidence of melting and suggesting that the annihilation of the thermal donors and of the stacking faults can be useful in studying the surface morphology in laser/electron beam irradiation. (18 refs.)

72006 Amorphization of germanium, gallium phosphide, and gallium arsenide by laser quenching from the melt. A.G.Cullis, H.C.Webber, N.G.Chew (Royal Signals & Radar Establ., Malvern, England).
Appl. Phys. Lett. (USA), vol.42, no.10, p.875-7 (15 May 1983).
The direct formation of amorphous layers on (111) Ge, GaP, and GaAs crystals is demonstrated to occur when these are transiently melted with 2.5-ns UV laser pulses below particular radiation energy density thresholds. Above these thresholds, the melt resolidification rate is reduced and in each case the (111) crystals exhbit a transition to a regime of profuse twin defect nucleation. Also for each material, laser melting of (001) crystal leads to defect-free recrystallization when amorphization does not occur. All amorphous layers exhibit a cellular thickness modulation which may be due to a fundamental instability in the recrystallization interface. (18 refs.)

72007 Multimodal laser strength distributions for materials. Yu.A.Demochko, V.V.Azarov, I.E.Sidoryuk, L.A.Skvortsov, V.M.Shaposhnikov, E.V.Shcherbina.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.57-62 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1075-80 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
It is shown that a Weibull distribution applies to the laser strength of a material when this is restricted by defects of one type. Data are given on the polymodal distribution of the strengths of insulating coatings made of TiO_2, lithium niobate, KDP, and DKDP. (14 refs.)

72008 Changes in the physical properties and structure of a semiconductor produced by pulsed laser radiation. S.G.Kiyak (Inst. of Appl. Problems in Mech. & Math., Acad. of Sci., Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.70-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1090-6 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
The basic trends in the interaction of a laser pulse with a semiconductor material are considered, including heating, melting, and epitaxial crystallization of the molten laser on a homosubstrate or heterosubstrate. (41 refs.)

72009 Features of laser damage to ferroelectric crystals. G.M.Zverev, V.S.Naumov, V.A.Pashkov, O.E.Sidoryuk, L.A.Skvortsov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.109-13 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1135-40 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
A review is presented of the main results on laser damage to lithium metaniobate crystals. Results are presented on the damage to the surface and bulk of these crystals. Possible mechanisms are discussed that explain the features of laser damage to ferroelectric crystals. (8 refs.)

72010 Excitation of surface and waveguide modes by intense laser radiation and their effects on surface damage of condensed media. A.M.Bonch-Bruevich, M.K.Kochengina, M.N.Libenson, V.S.Makin, S.D.Pudkov, V.V.Turbaev.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.152-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1186-93 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
A physical model is proposed for the specific damage to the surface of a metal or a semiconductor produced by pulsed polarized laser radiation, which involves the formation of regular parallel damage bands. The model is based on the view that there is parasitic excitation of surface electromagnetic waves and of waveguide modes, whose interference with the incident radiation results in the spatially modulated temperature distribution. The model provides a nonconflicting interpretation of the available experimental data. (26 refs.)

72011 Mechanisms of laser damage to transparent polymer materials. V.S.Nechitailo (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.159-63 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1194-9 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
Published mechanisms for large damage to transparent polymers are considered and it is shown that these mechanisms do not enable one to explain major features of the resistance of polymers on repeated irradiation. A mechanism is considered that involves absorbing defects, and a model for a defect is proposed as an inhomogeneous inclusion surrounded by the absorbing matrix. (23 refs.)

72012 Microdamage initiation in a transparent polymer on repeated laser irradiation. A.A.Manenkov, V.S.Nechitailo, A.S.Tsaprilov (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.164-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1200-2 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
The trends in microdamage of size ~ 1 μm in polymethylmethacrylate PMMA and modified PMMA have been examined on repeated exposure to laser beams with wavelengths of 1.06, 0.69, and 0.53 μm. The spatial statistics of $P_\mu(N)$ have been examined and the dependence of the microdamage concentration on energy density has been determined for the various wavelengths and for specimen temperatures from 300 to 460K. (3 refs.)

72013 CW CO_2-laser annealing and alloying of semiconductors. Zou Shi-chang, Lin cheng-lu (Shanghai Inst. of Metall., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.1-8 (Jan.-March 1983). [received: May 1983]
Annealing of the damaged layer of the ion-implanted semiconductors can be successfully achieved with the use of lasers, e.g. high intensity ruby-pulse laser, Nd:YAG laser and CW A^+ and Kr^+ lasers. However, a certain problem can occur when a laser is applied to semiconductor devices. For example the nonuniform reflectivity and absorption coefficients of the surface structure of semiconductor device can result in inhomogeneous annealing. The interference and the antireflection of SiO_2 in the multilayer structure of Si/SiO_2 could cause some local damage. Furthermore, owing to the relatively short absorption length of these lasers in silicon, the depth of annealing can also be subject to a certain limitation. In the west, there has been relatively very little publication about CO_2 laser annealing studies. Since 1979, the authors have carried out some work on the effect of the irradiation of semiconductors with CO_2 laser. In this paper, they focus on the discussion of the characteristics of CW CO_2 laser irradiation and its applications to the annealing of the damaged layer of ion-implanted Si and alloy formation on a GaAs surface. (17 refs.)

72014 Substrate heating effects in CO_2 laser annealing of ion-implanted silicon. M.Blomberg, K.Naukkarinen, T.Tuomi, V.-M.Airaksinen (Lab. of Phys., Helsinki Univ. of Technol., Espoo, Finland), M.Luomajarvi, E.Rauhala.
J. Appl. Phys. (USA), vol.54, no.5, p.2327-8 (May 1983).
A pulsed CO_2 laser has been used for the annealing of doped ion-implanted silicon crystals. Good recrystallization was achieved for a sample with a dopant density of 7×10^{15} cm^{-3}, when preheated to 850K. Damage caused by thermal runaway, however, made annealing of samples with a dopant concentration of this order difficult. The effect of the strong temperature dependence of the absorption coefficient at the CO_2 laser photon energy is considered. Melting model calculations give agreement with the experimental observations. (7 refs.)

72015 High-power laser radiation damage to transparent insulators. B.G.Gavrilov, V.I.Kulikov, V.V.Pedanov (O.Yu. Shmidt Inst. of Terrestrial Phys., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1446-51 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2226-34 (Nov. 1982). [received: May 1983]
An experimental investigation was made of the kinetics of the post-breakdown phenomena accompanying the focusing of high-power laser radiation inside transparent insulators (using the example of single-crystal potassium alum). Measurements were made of the rate of growth of the damage region and of the propagation velocity of the elastic wave, its amplitude and wavelength. The dimensions of the breakdown region were compared with those of the damage zone in the insulator. An analysis was made of the laser radiation energy distribution in the observed phenomenon. (9 refs.)

Thermophysical processes in the interaction of laser radiation with absorbing media .... See Entry 71160

Statistical trends in laser damage .... See Entry 71161

Pulse heating of a metal by a laser plasma in a subsonic air flow .... See Entry 71758

The investigation of zinc oxide film photodestruction by means of surface polariton spectroscopy and X-ray diffraction analysis .... See Entry 72277

Photo-induced changes of optical properties in noncrystalline As-S system films .... See Entry 72745

Effects in the optical and electrical properties of CdS crystals from the accumulation of structural defects under laser irradiation .... See Entry 72845

Evaporation instability and surface oxidation of a solid under irradiation .... See Entry 73254

Dynamics and spatial structure of the absorption at the photochemical stage in insulator destruction .... See Entry 73344

61.80C X-rays

Gate-width dependence of radiation-induced interface traps in metal/SiO_2/Si devices .... See Entry 72502

Accumulation and discharging of the hole charge in oxide layers of MIS structures .... See Entry 72510

Photoluminescence of iron-doped $KMgF_3$ .... See Entry 72850

61.80E Gamma rays

72016 Influence of an electric field on the accumulation and annealing of radiation defects in gallium arsenide. A.P.Mamontov, V.V.Peshev, I.P.Chernov (S.M. Kirov Polytech. Inst., Tomsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1371-2 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2126-8 (Dec. 1982). [received: May 1983]
The capacitance method of deep-level transient spectroscopy was used to investigate the temperature dependence of the accumulation of the *E*3 centers in the space charge layer and in the neutral bulk of gallium arsenide irradiated with ^{60}Co γ rays. The dependence obtained for this space charge layer was very different from that for the neutral bulk. (5 refs.)

Effect of irradiation on density of polymers .... See Entry 72028

Effect of gamma radiation on the direct-current resistivity of GeO_2 .... See Entry 72158

Increase in the minority-carrier lifetime in GaAs as a result of irradiation and heat treatment .... See Entry 72421

Determining surface state spectrum from measurements of steepness of transfer characteristics of MOS transistor at high and low frequencies .... See Entry 72505

Influence of irradiation temperature on radiative processes in MOS structures .... See Entry 72506

A new treatment for the interpretation of radical decay in γ-irradiated polyethylene .... See Entry 73347

61.80F Electrons and positrons

72017 Annealing of implantation defects in silicon through a quickly deflected electron probe. S.Panzer, R.Klabes.
Elektrie (Germany), vol.37, no.3, p.140-1 (1983). In German.
A method of the thermal annealing of implantation defects in semiconductors by means of an electron-beam is represented. Through an extremely quick time-linear periodically deflected electron probe a quasi-stationary line shaped surface limited high-temperature field in the semiconductor wafer is generated. The recrystallization of the implantation layer, being effected in the solid phase, takes place in implantation depths down to a few 1000 Å with a surface throughput of 10 cm^2 s^{-1}. (2 refs.)

Temperature dependence of accumulation efficiency and annihilation kinetics of primary Frenkel defects in KCl and KCl-I crystals in the temperature range 15-80K .... See Entry 71958

In-situ TEM observations of loop punching from helium platelet cavities in molybdenum .... See Entry 71960

Interaction of radiation defects with iron impurities in GaAs crystals .... See Entry 72003

Ion-beam damage in hollandite .... See Entry 72019

Morphological stability of electron beam melted aluminum alloys .... See Entry 72090

Sodium deposition in fast ion conductors .... See Entry 72152

Desorption of negative ions on metallic samples by very low energy electrons .... See Entry 72243

Comparison of H^+ and H^- ESD from hydrogen on platinum .... See Entry 72245

Distribution of relativistic electrons of a high current beam in a solid state target .... See Entry 72431

Electron beam induced damage in poly-Si gate MOS structures and its effect on long-term stability .... See Entry 72508

Magnetic susceptibility of neutron and electron irradiated quartz versus the 'glassy' thermal conductivity .... See Entry 72575

Optical polarization of nuclei and ESR in irradiation silicon .. See Entry 72703

Effect of electron flux on radiation damage in GaAs solar cells .... See Entry 73442

Irradiated solar cells fabricated from gallium-doped/boron-doped FZ and CZ silicon .... See Entry 73443

61.80H Neutrons

72018 Irradiation induced precipitation in tungsten based, W-Re alloys. R.K.Williams, F.W.Wiffen, J.Bentley, J.O.Stiegler (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.655-66 (April 1983).
Tungsten-base alloys containing 5, 11, and 25 pct Re were irradiated in the EBR-II reactor. Irradiation temperatures ranged from 600 to 1500°C. All compositions were irradiated to fluences in the range 4.3 to 6.1×10^{25} n/m^2 ($E>0.1$ MeV), and three 25 pct Re samples were also irradiated to 3.7×10^{26} n/m^2 at temperatures 700 to 900°C. Postirradiation examination included measurement of electrical resistivity at room temperature and lower temperatures, X-ray diffraction, optical metallography, microprobe analysis, and transmission electron microscopy. Irradiation induced resistivity decreases observed in most of the samples suggested second-phase precipitation. Complete results confirmed the precipitate formation in all samples, in disagreement with exist-

ing phase diagrams for the W-Re system. Electron diffraction showed the precipitates to be consistent with the cubic, Re-rich χ-phase and inconsistent with the σ-phase. Large variations in precipitate morphology and distribution were observed between the different compositions and irradiation conditions. (40 refs.)

The development and evaluation of SYNROC for high-level radioactive waste immobilization .... See Entry 70681

The resistivity inhomogeneity and the maximum possible mean resistivity of neutron-transmutation doped silicon .... See Entry 72389

Influence of thermal annealing on thermoelectric properties of normal and neutron-doped silicon crystals .... See Entry 72429

Magnetic susceptibility of neutron and electron irradiated quartz versus the 'glassy' thermal conductivity .... See Entry 72575

Changes in the optical properties of oxygen in silicon as a result of heat treatment and irradiation .... See Entry 72813

61.80J Ions

(for ion implantation, see 61.70T)

72019 Ion-beam damage in hollandite. J.C.Barry, J.L.Hutchison (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford), R.L.Segall.
J. Mater. Sci. (GB), vol.18, no.5, p.1421-5 (May 1983).
The phenomenon of ion-beam damage in hollandite, first reported by Headley (1981) has been investigated in the hollandite phase in Synroc, and a related electron-beam damage phenomenon has been investigated in a synthetic barium aluminium hollandite. An explanation of the beam damage phenomena is proposed in terms of twinning in the monoclinic form of hollandite. (11 refs.)

72020 Computer simulation of pit formation in metals by ion bombardment. R.P.Webb, D.E.Harrison,Jr. (Naval Postgraduate School, Monterey, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1478-81 (9 May 1983).
Computer simulations of ion-bombardment events which recrystallize the target demonstrate pit formation at 1.0 keV. Atoms are ejected from the first two target layers in the pit region. The remainder of the pit is created by replacement-collision sequences. Linear-cascade and spike-regime events are dynamically indistinguishable. (19 refs.)

Argon implantation in GaAs: damage and lattice site location analyses .... See Entry 71992

The nature of defect layer formation for arsenic ion implantation .... See Entry 71993

Si implantation in GaAs .... See Entry 71994

Transmission electron microscopic observation of precipitates in Si^+ ion-implanted GaAs .... See Entry 71995

Gettering of oxygen in Si wafers damaged by ion implantation and mechanical abrasion .... See Entry 71998

Substrate heating effects in CO_2 laser annealing of ion-implanted silicon .... See Entry 72014

The effect of ion beams on the composition of $Cu_2O(111)$ surfaces .... See Entry 72189

Proton and deuteron bombarded $Ga_{0.47}In_{0.53}As$ .... See Entry 72383

Omnidirectional proton irradiation of thin and thick solar cells .... See Entry 73440

61.80M Channelling, blocking and energy loss of particles

(see also 29.70 Energy loss and range relations)

72021 Charged-particle stopping in crystals. V.A.Khodyrev, E.I.Sirotinin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Phys. Status Solidi b (Germany), vol.116, no.2, p.659-71 (1 April 1983).
The energy loss by a charged particle moving along a given path in the crystal lattice is calculated in terms of quantum perturbation theory. In calculating the contribution of excitations with low energy transfer, the sum rule is used. The highly-excited states are described in a quasi-classical approximation. The results obtained with those approximations coincide in the intermediate region of excitation energy. The results obtained allow the electrons of the core and the valence electrons to be treated from a unified standpoint. The averaging of the obtained expression for $\Delta E(b)$ over the random impact-parameter distribution leads to the Lindhard-Scharff formula (1953). The calculated dependence of the mean relative proton-energy loss upon the dechanneling depth is compared with available experimental data. (23 refs.)

72022 Theory of ionization of fast atomic particles in a crystal. V.A.Bazylev, A.V.Demura (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.371-9 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.688-83 (Aug. 1982). [received: May 1983]
A theory is developed for the ionization of atomic particles channeled by the interplanar potential of a crystal. With allowance for the thermal vibrations of the nuclei, the authors have studied the suppression of the probability of loss of electrons by an ion in elastic interaction with the lattice atoms both in channeling and in a disoriented crystal. An anomalous dependence of the ionization probability on the angle between the ion momentum and the axes (or planes) of the crystal is predicted. It is shown that, in contrast to the ionization of fast atomic particles in an amorphous material, in a crystal this process can occur as the result of inelastic interaction with the electron subsystem of the crystal. (13 refs.)

Specific site location of S and Si in ion-implanted GaAs .... See Entry 71987

62.00 MECHANICAL AND ACOUSTIC PROPERTIES OF CONDENSED MATTER

(see also 46.30 Mechanics of solids and rheology, 61.70 Defects in crystals, 68.25 Surfaces and interfaces, 81. Materials science; for thermomechanical effects, see 65.70; for magnetomechanical effects, see 75.80; for piezoelectric effects, see 77.60; for elasto-optical effects, see 78.20H)

62.10 MECHANICAL PROPERTIES OF LIQUIDS

(for viscosity of liquids, see 66.20)

72023 Flory theory and excess compressibilities of binary liquid mixtures containing one polar component. K.Subramanyam Reddy, P.R.Naidu (Chem. Lab., Sri Venkateswara Univ., Tirupati, India).
J. Acoust. Soc. India, vol.9, no.2, p.50-3 (April 1981). [received: March 1983]
Isentropic compressibilities K_S of binary liquid mixtures of benezene+benzonitrile, benezene+methylpropylketone and cyclohexane+methylpropylketone were determined at 303.15K. The deviation in isentropic compressibility, k_s is negative over the whole range of composition in the mixtures, benzene+benzonitrile and benzene+methylpropylketone and it is positive in the system, cyclohexane+methylpropylketone. Excess isothermal compressibilities were then calculated and the results were analysed in the light of the statistical theory developed by Flory. The analyses showed that the theory qualitatively predicts the excess function in the three binary mixtures. (8 refs.)

72024 Adiabatic compressibility of branched chain hydrocarbons—pentanes and hexanes. A.M.Awwad, R.A.Pethrick (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
J. Mol. Liq. (Netherlands), vol.25, no.2, p.115-27 (April 1983).
Ultrasonic velocity and density measurements are reported on branched chain pentane and hexanes covering a temperature range 233 to 313K. The data are used to compute the Rao constant, the van der Waals b parameter and the free volumes. Interpretation of these parameters and the computed isothermal compressibilities are discussed with reference to the structure of molecules and the intermolecular interactions which occur in these systems. (22 refs.)

72025 Measurements of densities and dielectric constants of liquid propane from 90 to 300K at pressures to 35 MPa. W.M.Haynes (Thermophys. Properties Div., NBS, Boulder, CO, USA).
J. Chem. Thermodyn. (GB), vol.15, no.5, p.419-24 (May 1983).
Results of density and dielectric constant measurements on compressed liquid propane are reported. The results cover a temperature range from 90 to 300K at pressures to 35 MPa. The experimental densities and dielectric constants have been used to compute values for the Clausius-Mossotti function. (10 refs.)

72026 Apparent specific volumes of polymers in dilute solutions. D.Sarazin, J.Francois (Centre de Recherches sur les Macromolecules, CNRS, Strasbourg, France).
Polymer (GB), vol.24, no.5, p.547-52 (May 1983).
New results obtained on various polymers in solvents of differing molecular size and polarity confirm the dependence of their apparent specific volume ϕ_2 on polymer molecular weight and solvent molar volume. Existing models are discussed and a new model is proposed which assumes that ϕ_2 essentially depends on α, the expansion coefficient of the macromolecular coil, through the variation of the conformer sequence length in the chain. Some technical problems encountered with the vibrating tube densimeter are discussed. (34 refs.)

72027 Densities of liquid bismuth-silver and bismuth-cadmium alloys. K.Okajima, H.Sakao (Dept. of Metall., Nagoya Univ., Nagoya, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.215-22 (April 1983).
A study was undertaken to examine whether or not the new method employing a modified picnometer can be applied up to high temperatures above 900K. The densities of the liquid bismuth-silver and bismuth-cadmium alloys were measured with a sufficient precision in the temperature range from 630 to 1323K. It was found out that a complicated dependence of the density of the excess molar volume on the composition resulted at all experimental temperatures, probably due to existence of the ordering in the liquid alloys. (23 refs.)

Acoustic and thermodynamic properties of some liquids on hard sphere model with attractive interactions .... See Entry 72047

Ultrasonic behaviour of binary liquid mixtures of ethylenediamine with isoalcohols .... See Entry 72048

Free volume of sodium chloride solutions in water-dimethyl formamide mixtures from ultrasonic velocity .... See Entry 72049

62.20 MECHANICAL PROPERTIES OF SOLIDS (RELATED TO MICROSCOPIC STRUCTURE)

(see also 81.40 Treatment of materials and its effects on microstructures and properties, 81.70 Materials testing)

72028 Effect of irradiation on density of polymers. B.A.Briskman, S.I.Rozman.
J. Eng. Phys. (USA), vol.43, no.2, p.919-24 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.288-93 (Aug. 1982). [received: April 1983]
A survey is made of available data on the effect of irradiation on the density of several polymers. Results of measurements are presented pertaining to the density of polyethylene, polystyrene, polymethyl methacrylate, and polytetrafluoroethylene at temperatures from −196 to +100°C. (25 refs.)

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting .... See Entry 69790

Thermoelastic and relaxational properties of dielectric and metallic glasses at low temperature .... See Entry 72071

Graphitized carbon fibers: a new electrical conductor with high strength to weight properties .... See Entry 72371

A rational method for calculating mechanism maps .... See Entry 73097

62.20D Elastic constants

(see also 03.40D Mathematical theory of elasticity, 81.40J Elasticity and anelasticity)

72029 Elastic anomaly in $LiKSO_4$ crystals. M.E.M.Kassem, B.Mroz (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.449-54 (April 1983).
The infra-low frequency elastic properties of ferroelastic $LiKSO_4$ crystals were studied in the temperature range from 100 to 300K, with the inverted torsion pendulum technique. Temperature variations of numerical values of the shear moduli G_x, G_y and G_z were found to be anomalous around the phase transition point of these crystals, at about 190K. From these measurments the temperature variations of elastic stiffnesses $c_{44}=c_{55}$ and c_{66} of $LiKSO_4$ crystals could be calculated. The latter, together with the results previously obtained from piezoelectric investigations, allowed the authors to calculate the temperature changes of the non-zero components of the elastic stiffness tensor of $LiKSO_4$ crystals. (14 refs.)

72030 Elastic and magnetoelastic effects in $TmAl_2$ and other $REAl_2$ compounds. C.Lingner, B.Luthi (Phys. Inst., Univ. Frankfurt, Frankfurt/Main, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.86-8 (April 1983).
The elastic constants of $TmAl_2$ have been determined as a function of temperature. The crystal field effects on the elastic constants are clearly observed. A comparison of elastic and magnetoelastic coupling constants for the $REAl_2$ compounds is also given. (14 refs.)

72031 Elastic-constant anomalies in metallic superlattices: a molecular-dynamics study. I.K.Schuller, A.Rahman (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1377-80 (2 May 1983).
The elastic constants of Ni are calculated with use of molecular dynamics; at $\sim$5%[111] axial strain there is a large ($\sim$35%) softening of the C_{44} shear modulus and a stiffening of the in-plane Young's ($\sim$9.5%) and biaxial ($\sim$8%) moduli. These calculations are in remarkable agreement with experimental C_{44} for Mo/Ni superlattices. The experimentally observed transition to a highly disordered state occurs at the same strain value at which in the calculation the crystal becomes unstable. (15 refs.)

Improved resonance technique for materials characterization ...See Entry 71320

The glass as an elastic continuum ......See Entry 71380

Mechanical properties of metal/polymer composites ......See Entry 72032

Acoustic properties of a gadolinium single crystal in the region of magnetic phase transitions ......See Entry 72051

An examination of the longitudinal acoustic mode of polyethylene crystals (Raman spectra) ......See Entry 72799

Alkali treatment of coir fibres for coir-polyester composites ...See Entry 73062

Influence of V and Zr on the rolling texture, recrystallization, and anisotropy of the Young modulus of Ti-V and Ti-Zr alloys ......See Entry 73105

A new relationship of DC conductivity with loss modulus in PET ......See Entry 73120

The stiffness and modulus of elasticity of grey cast irons ......See Entry 73121

Cyclic stress relaxation of polycrystalline metals at elevated temperature ......See Entry 73122

Internal friction due to hysteretic dislocation motion in solid solution crystals ......See Entry 73123

Effect of some force factors on the rigidity characteristics of a magnesium-boron fiber composite material ......See Entry 73127

The shape of stress relaxation curves and the mechanical equation of state in molybdenum ......See Entry 73128

On Young's modulus of ferritic cast iron ......See Entry 73129

Strain mechanisms in grey cast iron ......See Entry 73134

Hydrophilic polymeric membranes obtained by radiation cast-copolymerization of ethyl acrylate with various monomers ......See Entry 73137

The effects of extensional creep and creep recovery on the dynamic properties of an unfilled and filled crosslinked polyester resin ......See Entry 73140

Strength and fracture toughness of reaction-bonded Si_3N_4 ......See Entry 73164

Fracture toughness/Young's modulus correlation for low-density fibrous silica bodies ......See Entry 73185

High temperature mechanical behaviour of silicon nitrides (Si_3N_4, Sialon) ......See Entry 73207

62.20F Deformation and plasticity

(inc. yield, ductility and superplasticity; see also 81.40L Deformation, plasticity and creep)

72032 Mechanical properties of metal/polymer composites. L.Nicodemo, L.Nicolais (Polymer Engng. Lab., Istituto di Principi di Ingegneria Chimica, Univ. of Naples, Naples, Italy).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.201-3 (May 1983).
The authors studied the mechanical properties of styrene-acrylonitrile polymer filled with iron and aluminium powders. The properties examined were stress/strain curves, elastic modulus, stress-at-break and elongation-at-break. It was found that poor adhesion occurred in composites with iron powders and no adhesion in composites with aluminium powders. (20 refs.)

72033 Topographic characteristics of superplastic deformation of two-phase brass. V.I.Portnoi, V.A.Kozhanov (Inst. of Steel & Alloys, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.592-7 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the characteristics of the deformation relief of two-phase brass L59 in the course of superplastic deformation. New surface zones were found on grain boundaries oriented at right-angles to the stretching axis. Shear and bending of marker scratches near the grain boundaries were also observed. The displacement of the scratches and the width of the deformation zones were used to estimate the contributions of grain-boundary slip and of the diffusion creep to the total elongation. A correlation was found between the anisotropy of the relative elongation and the anisotropy of grain-boundary slip. (8 refs.) *A.T.*

72034 A micromechanical theory of grain-size dependence in metal plasticity. G.J.Weng (Dept. of Mech. & Materials Sci., Rutgers Univ., New Brunswick, NJ, USA).
J. Mech. & Phys. Solids (GB), vol.31, no.3, p.193-203 (1983).
The effect of grain-size on the elastoplastic behavior of metals is investigated from the micromechanics standpoint. First, based on the observations that dislocation pile-ups, formation of cell structures, and other inelastic activities influenced by the presence of a grain boundary actually take place transcrystallinely, a grain size dependent constitutive equation is proposed for the slip deformation of slip systems. By means of a modified Hill's self-consistent relation the local stress of a grain is calculated, and used in conjunction with this constitutive equation to evaluate the plastic strain of each constitutent grain. The grain-size effect on the plastic flow of polycrystals then can be determined by an averaging process. To check the validity of the proposed theory it was finally applied to predict the stress-strain curves and flow stresses of copper at various grain-sizes. The obtained results were found to be in good agreement with experimental data. (21 refs.)

Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure' ......See Entry 69779

The influence of the flow and material characteristics on failure analysis ......See Entry 70694

Theories of nonlocal plasticity ......See Entry 71396

Letter concerning the paper 'On the double-sliding free-rotating model for the deformation of granular materials' ......See Entry 71402

Role of geometry in plastic instability and fracture of tubes and sheet ......See Entry 71467

Structural changes in nickel after ultrasonic action with subthreshold amplitudes in liquid helium ......See Entry 71967

Theoretical latent hardening of crystals in double-slip. II. FCC crystals slipping on distinct planes ......See Entry 71968

Structure and properties of chromomanganese austenitic steels hardened by hydraulic extrusion ......See Entry 71971

Investigation of changes in the grain-boundary structure as a result of recrystallization of a magnesium alloy after weak deformation ......See Entry 71972

Crystallogeometric features of the subgrain structure and their relationship to the deformation texture ......See Entry 71973

Acoustic emission measurements of a shape-memory alloy ......See Entry 72054

Structural relationships between spontaneous strain and acoustic properties in ferroelastics ......See Entry 72101

Effect of uniaxial compression on the ferroelastic phase transitions in layered $KSc(MoO_4)_2$ ......See Entry 72103

Macromechanism of powder deformation in the incoherent zone during rolling ......See Entry 73018

Effect of composition of powder mixtures and rolling temperature on the compactibility and properties of strip ......See Entry 73027

Reductive additives in powder metallurgically prepared $Cu\text{-}Nb_3Sn$ composite wires ......See Entry 73030

Alkali treatment of coir fibres for coir-polyester composites ...See Entry 73062

Strengthening of polyphase Si_3N_4 materials through oxidation ......See Entry 73100

Numerical determination of the parameters of Krupkowski's function for a torsion test taking into consideration the strain hardening ranges ......See Entry 73108

Behaviour of titanium alloy Ti-6% Al-4% V in the range of hot heating. ......See Entry 73113

Control of microstructures of ($\alpha+\beta$)-titanium alloys ......See Entry 73115

Cyclic stress relaxation of polycrystalline metals at elevated temperature ......See Entry 73122

Internal friction due to hysteretic dislocation motion in solid solution crystals ......See Entry 73123

The shape of stress relaxation curves and the mechanical equation of state in molybdenum ......See Entry 73128

Bending strength of silicon nitride at 1250°C under static and cyclic bending load ......See Entry 73130

Effect of structural defects on the sorption volume and strength of glass reinforced plastics ......See Entry 73131

Effect of plasticisation on the durability of orientated polymers ......See Entry 73132

Investigation of stresses created by electrically insulating coatings in electrical steel sheet with a ribbed texture ......See Entry 73133

Strain mechanisms in grey cast iron ......See Entry 73134

Analysis of the characteristics of lumped deformation of heterophase crystalline materials ......See Entry 73135

Relationship between the coefficients of normal anisotropy in the plastic behaviour of sheet metals ......See Entry 73136

Hydrophilic polymeric membranes obtained by radiation cast-copolymerization of ethyl acrylate with various monomers ......See Entry 73137

Bending properties of creased zones of paperboard related to interlaminar defects ......See Entry 73138

Effect of vacuum-treatment on mechanical properties of W-Ni-Fe heavy alloy ......See Entry 73139

Straw-reinforced polyester composites ......See Entry 73141

Characteristics of microstructure during tensile deformation of superplastic Al-Zn eutectoid alloy ......See Entry 73143

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures ......See Entry 73147

Residual and trace element effects on the high-temperature creep strength of austenitic stainless steels ......See Entry 73148

The effect of cerium on high temperature tensile and creep behavior of a superalloy ......See Entry 73149

Plastic constraint and ductility in tensile notched specimens of amorphous $Pd_{78}Cu_6Si_{16}$ ......See Entry 73150

The effect of shear bands on service properties of Ti-6Al-2Sn-4Zr-2Mo-0.1Si forgings ......See Entry 73151

Deformation behavior of blended elemental Ti-6Al-4V compacts ......See Entry 73152

Evaluation of the long-term deformation behaviour of plastic materials ......See Entry 73153

The tensile strengths of single powders and binary mixtures ...See Entry 73154

Effect of the type of binding material on the properties of refractory glass-fiber heat-insulation products ...See Entry 73155

Structure and properties of permeable fine-fiber materials produced from powders ...See Entry 73157

Change in transverse strain coefficient in a plane stress state ...See Entry 73158

Link between stress and strain of initially anisotropic materials with anisotropic strain hardening ...See Entry 73159

Dependence of the strength of materials on temperature and strain rate ...See Entry 73160

Plastic deformation of a metastable stainless steel at low temperatures ...See Entry 73161

Deformation of polymeric compounds based on synthetic rubber SKTN in the operating temperature range 203-343K ...See Entry 73162

Subsurface plastic deformation in machining 6Al-2Sn-4Zr-2Mo titanium alloy ...See Entry 73163

Fracture strains in biaxially loaded 2024 aluminum tubes ...See Entry 73169

Plastic deformation in the course of fracture of ferrite-pearlitic steels ...See Entry 73175

The effect of non-uniform bending deformation on the stability of circumferential growth of through-wall cracks in brass tubes ...See Entry 73178

The influence of morphology and molecular weight on ductile-brittle transitions in linear polyethylene ...See Entry 73181

Impact strength of En8 steel diffusion bonds ...See Entry 73182

Grain boundary sliding and stress concentration during creep . See Entry 73197

The enhancement of hydrogen attack in steel by prior deformation ...See Entry 73200

Microstructures and mechanical properties of hot isostatically pressed powder metallurgy alloy APK-1 ...See Entry 73204

Sintered boron—production and properties. II. Mechanical and thermophysical properties ...See Entry 73208

Laws of plastic strain and fatigue fracture of metals in torsion ...See Entry 73209

Influence of the type of solidification of a cast nickel alloy of the ZhS6 family on its high temperature strength ...See Entry 73211

The interaction of dislocation with Θ'-precipitates in a Al-2.8% Cu-alloy during fatigue tests ...See Entry 73215

Damage during friction and dislocation structure of gold-platinum solid solutions ...See Entry 73219

Ductility and the abrasive wear of an ultrahigh strength steel ...See Entry 73231

Effect of pH on the stress corrosion cracking of α-brass in chlorate solution ...See Entry 73253

Micro-hardness of non-irradiated uranium dioxide ...See Entry 73292

62.20H Creep

(see also 81.40L Deformation, plasticity and creep)

72035 On the scaling behaviour in a log σ-log $\dot{\varepsilon}$ diagram. F.Povolo (Comision Nacional de Energia Atomica, Buenos Aires, Argentina), A.J.Marzocca.
J. Mater. Sci. (GB), vol.18, no.5, p.1426-32 (May 1983).
The significance of scaling behaviour in the creep and stress relaxation log σ-log $\dot{\varepsilon}$ curves is analysed. It is shown that such a property imposes some restrictions on the parameters of the theoretical models. Finally, the formalism is applied to some constitutive equations used in the literature to describe creep and stress relaxation data. (12 refs.)

72036 Theory of steady-state creep with a complex stress state. A.Yakovlyuk, E.Meleshko, S.Onopyuk (Belostok Polytech. Inst., Belostok, Poland).
Strength Mater. (USA), vol.14, no.5, p.598-602 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.28-31 (May 1982). [received: May 1983]
The theory is based on similarity of creep curves with different principal-stress ratios. An optimum method described for obtaining the equations makes it possible to adequately describe creep within a broad range of types of stress states on the basis of a limited amount of empirical data. Using the example of nodular iron, the existence is demonstrated of similarity among creep curves. (4 refs.)

Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure' ...See Entry 69779

Application of the ASME-code-case N 47 to a typical thick-walled HTR-component made of Incoloy 800 ...See Entry 70645

Materials available and the present state of research into the basis for the design of high temperature components for HTR-plants ...See Entry 70688

Creep and rupture strength with a nonuniform stress state ...See Entry 71405

Topographic characteristics of superplastic deformation of two-phase brass ...See Entry 72033

The temperature dependence of coefficient of viscosity for $Cu_{60}Zr_{40}$ and $Ni_{64}Zr_{36}$ metallic glasses ...See Entry 72148

Hot pressing and properties of different Si_3N_4 qualities ...See Entry 73051

The sintering of creep-induced cavities in a low-alloy ferritic steel (1Cr1Mo0.75V) ...See Entry 73112

Cyclic stress relaxation of polycrystalline metals at elevated temperature ...See Entry 73122

The effects of extensional creep and creep recovery on the dynamic properties of an unfilled and filled crosslinked polyester resin ...See Entry 73140

Role of grain boundary segregation in diffusional creep ...See Entry 73144

Crack and cavity nucleation at interfaces during creep ...See Entry 73145

The effects of segregation on the kinetics of intergranular cavity growth under creep conditions ...See Entry 73146

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures ...See Entry 73147

Residual and trace element effects on the high-temperature creep strength of austenitic stainless steels ...See Entry 73148

The effect of cerium on high temperature tensile and creep behavior of a superalloy ...See Entry 73149

The effect of shear bands on service properties of Ti-6Al-2Sn-4Zr-2Mo-0.1Si forgings ...See Entry 73151

Evaluation of the long-term deformation behaviour of plastic materials ...See Entry 73153

Mechanical properties of glass-crystal structures based on corundum ...See Entry 73156

High temperature embrittlement of Ni and Ni-Cr alloys by trace elements ...See Entry 73198

Allowing for strength anisotropy in estimating the rupture strength of actual tubes in a plane stress state ...See Entry 73210

Statistical modeling of the creep characteristics of structural materials ...See Entry 73305

62.20M Fatigue, brittleness, fracture, and cracks

(inc. hardness; see also 81.40N Fatigue, embrittlement and fracture)

72037 The role of microcracking during crack growth in brittle materials. E.Smith (Metall. Dept., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.204-6 (May 1983).
The author shows that microcracking away from the immediate vicinity of a crack tip in a brittle material, does not enhance J_{IC} because of the reduced elastic modulus within the outer zone of microcracks. Instead it is believed that microcracking is indicative of a distribution of failure stresses for the material elements, and this causes the crack front to become irregular, with a consequential increase in J_{IC}. Furthermore, this irregularity also leads to an enhanced resistance to crack growth. (13 refs.)

72038 A fracture mechanics analysis of indentation-induced Palmqvist crack in ceramics. K.Niihara (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.221-3 (May 1983).
A model is presented for Palmqvist cracks based on fundamental fracture mechanics principles. The K. Niihara et al. (1982) approach is re-established. Some theoretical foundation is given to empirical correction factor, $(H/E\phi)^{2/5}$ where H is hardness, E is Young's modulus and ϕ is the constraint factor. (18 refs.)

72039 Multiplicity of causes of grain-boundary fracture. A.S.Drachinskii (Inst. of Problems in Mateials Sci., Acad. of Sci., Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.598-604 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
It is shown that grain-boundary fracture may be due to equilibrium and nonequilibrium segregation, and other structure states. For example, viscous grain-boundary structure is due to the hardening of grains in the presence of unhardened zones along the grain boundaries. In the case of brittle and viscous fracture along grain boundaries the proportion of the grain-boundary component depends on the ratio of the strength of a body to the strength of grain boundaries. The multiplicity of structure states that determine the strength and their combinations for the main body and grain boundaries are responsible for the great variety of causes of grain-boundary fracture. (35 refs.) *A.T.*

72040 The discreteness of fracture. G.I.Barenblatt.
Strength Mater. (USA), vol.14, no.5, p.695-9 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.107-10 (May 1982). [received: May 1983]
The main assumption of the theory of discreteness of fracture proposed by V.S. Ivanova (1975) is discussed and it is noted that the assumption is not theoretically justified and contradicts the available literature. (8 refs.)

72041 Comment on the article by G.I. Barenblatt 'The discreteness of fracture'. V.S.Ivanova.
Strength Mater. (USA), vol.14, no.5, p.699-701 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.111-13 (May 1982). [received: May 1983]
The criticism by G.I. Barenblatt (see ibid., vol.14, no.15, p.695, 1983) is reduced to the statement that the author of the reviewed studies does not know what theory and self-similarity are. If one examines the method of criticism used by Barenblatt, it must be said immediately that he does not know what fatigue and self-similarity are and, as indicated, is not familiar with the investigations carried out by G.C. Sih (1973) in which it was explained why the crack grows in a jumpwise manner. The fact that Barenblatt is not familiar with the special features of fatigue failure and uses incorrectly the concept of self-similarity has caused him to interpret incorrectly the concept of the discreteness and self-similarity of fatigue fracture. (14 refs.)

72042 Comment on the discreteness of fracture. G.I.Barenblatt.
Strength Mater. (USA), vol.14, no.5, p.702 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.113-14 (May 1982). [received: May 1983]
The author replies to V.S. Ivanova's reply (see ibid., vol.14, no.5, p.699, 1983) to his criticism (see ibid., vol.14, no.5, p.695, 1983) of her theory of discreteness of fracture. He justifies his criticism of this work. (no refs.)

72043 Reply to G.I. Barenblatt's comments [on 'the discreteness of fracture']. V.S.Ivanova.
Strength Mater. (USA), vol.14, no.5, p.703 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.114 (May 1982). [received: May 1983]
The authoress replies to the new comments of G.I. Barenblatt (see ibid., vol.14, no.5, p.702, 1983) and contends that they are of little significance because they contain no new criticism. (no refs.)

Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure' ...See Entry 69779

Transferability of post yield fracture data from small scale to large scale specimens and plant components ...See Entry 70646

Influence of cladding on the linear elastic RPV analysis during a loss-of-coolant accident ...See Entry 70647

Numerical simulation of post-yield fracture mechanics experiments and the possibility of application of results to plant components ...See Entry 70695

Creep and rupture strength with a nonuniform stress state ...See Entry 71405

Overload retardation models of fatigue crack growth ...See Entry 71460

Role of geometry in plastic instability and fracture of tubes and sheet ...See Entry 71467

Brittle fracture of plates in tension—relative significance of boundary reflected body and Rayleigh waves ...See Entry 71479

Thermodynamics of the propagation process of quasibrittle cracks ...See Entry 71485

Effects of rigid grain separation on the diffusive growth of crack-like cavities on grain boundaries ... See Entry 71969

Helium reemission during implantation of silicon carbide ... See Entry 71991

Mechanical properties of metal/polymer composites ... See Entry 72032

Preparation and properties of SmB_6 and SmB_4 single crystals ... See Entry 72980

Some mechanical and electrochemical properties of electroless nickel ... See Entry 73015

The kinetics of densification of binary titanium-chromium diboride with copper-nickel binder ... See Entry 73057

Effect of some force factors on the rigidity characteristics of a magnesium-boron fiber composite material ... See Entry 73127

The shape of stress relaxation curves and the mechanical equation of state in molybdenum ... See Entry 73128

Strain mechanisms in grey cast iron ... See Entry 73134

Effect of vacuum-treatment on mechanical properties of W-Ni-Fe heavy alloy ... See Entry 73139

Straw-reinforced polyester composites ... See Entry 73141

Crack and cavity nucleation at interfaces during creep ... See Entry 73145

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures ... See Entry 73147

The effect of cerium on high temperature tensile and creep behavior of a superalloy ... See Entry 73149

The effect of shear bands on service properties of Ti-6Al-2Sn-4Zr-2Mo-0.1Si forgings ... See Entry 73151

Strength and fracture toughness of reaction-bonded Si_3N_4 ... See Entry 73164

The load concentration factor and the statistic theory of crack propagation of a unidirectionally fiber-reinforced composite ... See Entry 73165

SEM observations of the initiation and propagation of cracks in a short fibre-reinforced thermoplastic composite under stress ... See Entry 73166

Effect of oxidizing environment on the strength of H451, PGX and IG-11 graphites ... See Entry 73167

The use of acoustic emission techniques to monitor fracture processes in high strength precipitation hardened aluminum alloys ... See Entry 73168

Fracture strains in biaxially loaded 2024 aluminum tubes ... See Entry 73169

Statistical modeling of fatigue-crack growth in a nickel-base superalloy ... See Entry 73170

Estimating the statistical properties of crack growth for small cracks ... See Entry 73171

Crack closure studies under constant amplitude loading ... See Entry 73172

The effect of stress relaxation on the tearing of vulcanized rubber ... See Entry 73173

Near-threshold fatigue crack propagation of several high strength steels ... See Entry 73174

Plastic deformation in the course of fracture of ferrite-pearlitic steels ... See Entry 73175

Hydrides and delayed hydrogen cracking in zirconium and its alloys ... See Entry 73176

Fragmentation behavior of Armco iron and HF-1 steel explosive-filled cylinders ... See Entry 73177

The effect of non-uniform bending deformation on the stability of circumferential growth of through-wall cracks in brass tubes ... See Entry 73178

Response of cracks in structural materials to short pulse loads ... See Entry 73179

Dynamic fatigue of brittle materials containing indentation line flaws ... See Entry 73180

The influence of morphology and molecular weight on ductile-brittle transitions in linear polyethylene ... See Entry 73181

Impact strength of En8 steel diffusion bonds ... See Entry 73182

On the correlation between solid-particle erosion and fracture parameters in SiC ... See Entry 73183

Some aspects of crack growth and failure in fibre reinforced composites ... See Entry 73184

Fracture toughness/Young's modulus correlation for low-density fibrous silica bodies ... See Entry 73185

Relation of load to radial crack length for spherical indentations in hot-pressed ZnS ... See Entry 73186

Mechanical properties of sintered and nitrided laser-synthesized silicon powder ... See Entry 73187

X-ray diffraction studies of thermally shocked periclase ... See Entry 73188

Scanning electron microscope and ferromagnetic resonance investigations of fractured metglas 2826 alloy ... See Entry 73190

Thermal shock resistances and fracture toughnesses of SiC and B_4C disks at elevated temperature ... See Entry 73193

Fracture mechanics properties for thermal shock of the mesophase pitch carbons during the graphitizing heat treatment process ... See Entry 73194

Thermal shock resistance and fracture toughness of graphite with different arrangements of coke grain size and porosity ... See Entry 73195

Compression testing and cracking of plain concrete ... See Entry 73196

Grain boundary sliding and stress concentration during creep ... See Entry 73197

High temperature embrittlement of Ni and Ni-Cr alloys by trace elements ... See Entry 73198

Analyzing statistical variability of fracture properties ... See Entry 73199

The enhancement of hydrogen attack in steel by prior deformation ... See Entry 73200

Effects of hydrogen on near-threshold crack propagation in niobium ... See Entry 73201

Crack propagation of high strength steels in a gaseous hydrogen atmosphere ... See Entry 73202

S-N curve inversion of nickel-base superalloy at elevated temperature ... See Entry 73203

Microstructures and mechanical properties of hot isostatically pressed powder metallurgy alloy APK-1 ... See Entry 73204

The effect of temperature, specimen size, and geometry on the fracture toughness of a 3 pct NiCrMoV low pressure turbine disc steel ... See Entry 73205

Some solid-state properties of blends of polyethylene terephthalate and polyamide-6,6 ... See Entry 73206

High temperature mechanical behaviour of silicon nitrides (Si_3N_4, Sialon) ... See Entry 73207

Sintered boron—production and properties. II. Mechanical and thermophysical properties ... See Entry 73208

Laws of plastic strain and fatigue fracture of metals in torsion ... See Entry 73209

Allowing for strength anisotropy in estimating the rupture strength of actual tubes in a plane stress state ... See Entry 73210

Influence of the type of solidification of a cast nickel alloy of the ZhS6 family on its high temperature strength ... See Entry 73211

Discreteness and self-similarity of failure in stable fatigue crack growth ... See Entry 73212

Application of the kinetic strength concept to determination of the longevity of specimens with a stress raiser under static load ... See Entry 73213

Dynamic crack growth during pop-in fracture in 7075 aluminum alloy ... See Entry 73214

The interaction of dislocation with Θ'-precipitates in a Al-2.8% Cu-alloy during fatigue tests ... See Entry 73215

Determination of fracture-mechanic properties by using the near-field of dynamically loaded cracks ... See Entry 73216

Investigation into the yield behaviour in the area close to the crack tip of a fine-grained structure steel ... See Entry 73217

Damage during friction and dislocation structure of gold-platinum solid solutions ... See Entry 73219

Effect of simulated body environments on crack propagation in alumina ... See Entry 73234

Anomalous corrosion of hydrogen-containing ferritic steels in aqueous acid solution ... See Entry 73262

The cohesive and adhesive strength of ice [on metal substrates] ... See Entry 73271

Surface melting of a medium carbon steel by laser treatment ... See Entry 73272

A fundamental study of laser transformation hardening ... See Entry 73275

Micro-hardness of non-irradiated uranium dioxide ... See Entry 73292

Effect of indenter geometry on controlled-surface-flaw fracture toughness ... See Entry 73293

Examination of delayed fracture tests on prestressing steels ... See Entry 73294

Prediction of the collapsing pressure of glass fiber-reinforced plastic membranes by the acoustic emission method ... See Entry 73306

Computation of curves of residual-stress relaxation at normal and elevated temperatures ... See Entry 73307

Scanning electron microscopy studies on mechanism of rubber tear ... See Entry 73310

62.20P Tribology

(see also 81.40P Friction, lubrication and wear)

72044 **The dependence of the friction coefficient on the crystal structure of solids: physical principles.** S.S.Karapetian, Yu.I.Korostelin (State Committee on Standards, Moscow, USSR).
Wear (Switzerland), vol.85, no.2, p.133-41 (1 March 1983).
The problem of contact interaction of pairs of the same pure metals with differing crystal structures was studied. The probability of formation of adhesive bonds, the formation of the true contact area and its dependence on the hardness of the metals and the atomic shearing force in the slip plane were investigated. Formulae were derived to calculate the friction coefficient and hardness of metals of various crystal structures in a wide temperature range from 0K up to temperatures close to the melting point. (15 refs.)

Effect of surface roughness on the stress-strain state of rubbing bodies ... See Entry 71493

Some mechanical and electrochemical properties of electroless nickel ... See Entry 73015

The kinetics of densification of binary titanium-chromium diboride with copper-nickel binder ... See Entry 73057

Subsurface plastic deformation in machining 6Al-2Sn-4Zr-2Mo titanium alloy ... See Entry 73163

On the correlation between solid-particle erosion and fracture parameters in SiC ... See Entry 73183

Some solid-state properties of blends of polyethylene terephthalate and polyamide-6,6 ... See Entry 73206

Tribological properties of sintered polycrystalline and single-crystal silicon carbide ... See Entry 73218

Antifriction properties of chromium alloys ... See Entry 73220

Tribological properties of cast graphitic-aluminium composites ... See Entry 73221

Wear characteristics of composites: effect of fiber orientation ... See Entry 73222

The role of microstructure in the wear of selected steels ... See Entry 73223

A study of wear characteristics of different materials ... See Entry 73224

On the wear of aluminium-corundum composites ... See Entry 73225

Effect of temperature on the cavitation erosion of cast iron ... See Entry 73226

Subsurface damage during dry sliding wear of Al-Al_3Ni eutectic alloy ... See Entry 73227

Morphology of ductile metals eroded by a jet of spherical particles impinging at normal incidence ... See Entry 73228

The unlubricated wear of flake graphite cast iron ... See Entry 73229

Vibratory cavitation tests at elevated temperature ... See Entry 73230

Ductility and the abrasive wear of an ultrahigh strength steel ... See Entry 73231

Subsurface hardening in erosion-damaged copper as inferred from the dislocation cell structure, and its dependence on particle velocity and angle of impact ... See Entry 73232

The interaction between two wearing surfaces. I. Copper sliding on Cu-Be and Cu-Be sliding on Cu-Be ... See Entry 73233

62.30 MECHANICAL AND ELASTIC WAVES

(see also 03.40K Mathematical aspects)

72045 Dispersion of harmonic waves in laminated elastoplastic composites. V.M.Antonenko, N.A.Shul'ga (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.668-71 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.86-8 (May 1982). [received: May 1983] (5 refs.)

Scattering of elastic waves by a fluid inclusion .... See Entry 71442

62.40 ANELASTICITY, INTERNAL FRICTION, AND DAMPING

(see also 81.40J Elasticity and anelasticity)

72046 Low frequency elastic properties of glasses at low temperature. A.K.Raychaudhuri, S.Hunklinger (Max-Planck-Inst., Stuttgart, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.485-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The authors have measured the elastic properties (sound velocity and internal friction) of glasses below 1K in the audiofrequency range (~1 KHz). The results obtained are discussed in the framework of the tunneling model of glasses. The major assumption of the tunneling model regarding tunneling states with long relaxation times has been verified. (5 refs.)

On the scaling behaviour in a log σ-log $\dot{\varepsilon}$ diagram .... See Entry 72035

Phase separation in epoxy resins containing polyethersulphone .... See Entry 72124

A new relationship of DC conductivity with loss modulus in PET .... See Entry 73120

Internal friction due to hysteretic dislocation motion in solid solution crystals .... See Entry 73123

Internal friction of palladium boron alloys .... See Entry 73126

The effect of stress relaxation on the tearing of vulcanized rubber .... See Entry 73173

62.50 HIGH-PRESSURE AND SHOCK-WAVE EFFECTS IN SOLIDS

Density-functional theory for solid nitrogen and carbon dioxide at high pressure .... See Entry 71938

Influence of low temperature high pressure and high temperature high pressure treatment on structure and superconductivity of amorphous alloy $La_{80}Al_{20}$ .... See Entry 72528

Fragmentation behavior of Armco iron and HF-1 steel explosive-filled cylinders .... See Entry 73177

62.60 ACOUSTIC PROPERTIES OF LIQUIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for second sound in quantum fluids, see 67.40, 67.50 and 67.60)

72047 Acoustic and thermodynamic properties of some liquids on hard sphere model with attractive interactions. S.S.Bhatti (Dept. of Phys., Guru Nanak Dev. Univ., Amritsar, India), D.P.Singh.
J. Acoust. Soc. India, vol.9, no.2, p.39-43 (April 1981). [received: March 1983]
Ultrasonic velocity data available in the literature have been used to calculate isothermal compressibility, pseudo-Gruneisen parameter and Rao's acoustic constant as functions of temperature for seven pure liquids. The values of these parameters are compared with those computed from the alternative expressions obtained by Bhatnagar and Sharma (Ind. J. Pure Appl. Phys., vol.14, p.107, 1976) on the basis of the hard sphere model with attractive interactions. Surface tension, energy and Eotvos constant, expansivity and pressure coefficient of bulk modulus obtained on this model are compared with their experimental values. An explanation of the observed results is given in terms of molecular interactions in the liquids studied. (20 refs.)

72048 Ultrasonic behaviour of binary liquid mixtures of ethylenediamine with isoalcohols. D.N.Rao, A.Krishnaiah, P.R.Naidu (Dept. of Chem., Sri Venkateswara Univ. Coll. of Engng., Tirupati, India).
J. Acoust. Soc. India, vol.9, no.2, p.44-8 (April 1981). [received: March 1983]
Isentropic compressibilities, K_s of ethylenediamine+i-propanol, +i-butanol, and +i-pentanol were measured at 303.15 and 313.15K. The mixtures exhibit negative deviations in K_s. The negative deviation indicates that hydrogen bond interaction between unlike molecules dominates in the mixtures. Further, the negative deviation increases with increase in temperature. (11 refs.)

72049 Free volume of sodium chloride solutions in water-dimethyl formamide mixtures from ultrasonic velocity. S.O.Pillai, S.Natarajan, P.K.Palanisamy (Dept. of Phys., Coll. of Engng., Anna Univ., Madras, India).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1616-18 (May 1983).
Free volume of sodium chloride solutions in water-dimethyl formamide mixtures have been evaluated using ultrasonic velocities from new formulas obtained by dimensional analysis. The results have been discussed in the light of existing theories. (6 refs.)

72050 Temperature dependence and asymmetry of the hypersound velocity in cyanobiphenyl liquid crystals. G.W.Bradberry, C.F.Clarke (Dept. of Phys., Univ. of Exeter, Exeter, England).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.305-8 (9 May 1983).
Measurements of the hypersound velocity have been made as a function of temperature for two principal directions in cyanobiphenyl samples. Velocity asymmetry is observed in both the nematic and smectic phases. The behaviour of the velocity in the vicinity of the phase-transition temperatures is discussed. (8 refs.)

Finite amplitude method for the determination of the acoustic nonlinearity parameter *B/A* .... See Entry 71282

Self-action and stimulated scattering effects of sound beams in absorbing liquids—thermal self-focusing .... See Entry 71285

Flory theory and excess compressibilities of binary liquid mixtures containing one polar component .... See Entry 72023

Adiabatic compressibility of branched chain hydrocarbons—pentanes and hexanes .... See Entry 72024

62.65 ACOUSTIC PROPERTIES OF SOLIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for lattice dynamics and phonons, see 63.; for magnetoacoustic effects, see 72.55; for acoustoelectric effects, see 72.50; for acousto-optical effects, see 78.20H)

72051 Acoustic properties of a gadolinium single crystal in the region of magnetic phase transitions. D.I.Anikeev, L.K.Zarembo, S.N.Karpachev, I.K.Kumskova, O.D.Chistyakov, E.M.Savitskii (M.V. Lomonosov State Univ., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.622-4 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The linear acoustic characteristics (absorption, velocity of sound) and the effective nonlinear elastic parameter were determined as a function of temperature in the range from liquid nitrogen to above 300K. Singularities of these properties were observed at a spin-reorientation temperature and at the Curie point. (8 refs.) *A.T.*

72052 An experimental investigation of pass bands and stop bands in two periodic particulate composites. V.K.Kinra (Aerospace Engng. Dept., Texas A&M Univ., College Station, TX, USA), E.L.Ker.
Int. J. Solids & Struct. (GB), vol.19, no.5, p.393-410 (1983).
An important property of periodic composites is that the dispersion curve is characterised by pass bands and stop bands. In the past these have been demonstrated, analytically and experimentally, for layered and fibrous composites. The purpose of the present experimental investigation is to show that the same phenomena exist in periodic particulate composites. The phase velocity of longitudinal waves through periodic particulate composites was measured as a function of frequency. Two composites were studied: (1) Glass spheres in an epoxy matrix and; (2) Steel spheres in a PMMA matrix. Two pass bands were observed in the first composite, whereas three pass bands could be identified in the second. The experimental technique employed was that of through-transmission of an ultrasonic pulse. (29 refs.)

72053 The scattering of ultrasonic waves by polycrystals. II. Shear waves. S.Hirsekorn (Fraunhofer-Inst. fur Zerstorungsfreie Prufverfahren, Univ. of Saarbrucken, Saarbrucken, Germany).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1160-3 (April 1983).
For pt.I see ibid., vol.72, p.1021 (1982). The theory of ultrasonic propagation in polycrystals presented in a previous paper is used to calculate the scattering coefficient and the phase and group velocities of plane shear waves in polycrystals of cubic symmetry with randomly orientated grains. The calculation was done in second-order perturbation theory using the assumption that the changes in the elastic constants and in the density from grain to grain are small. The asymptotic values at low κa (Rayleigh scattering) are exactly the same as the well-known results from Bhatia and Moore. Numerical calculations are carried out for some examples. (4 refs.)

72054 Acoustic emission measurements of a shape-memory alloy. R.S.Geng, B.Britton, R.W.B.Stephens (Phys. Dept., Chelsea Coll., Univ. of London, London, England).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1217-22 (April 1983).
A description is given of a systematic study of the acoustic emission (AE) characteristics of a specific shape-memory alloy, a copper-based Betalloy. Using a narrow-band AE measuring system, a considerable change in AE signals was observed in the different phase states of the Betalloy, the changes being particularly significant in the slope changes of the amplitude-distribution curves. By careful correlation of AE signals with the stress-induced martensitic transformation, it was found, in repetition cycles, that a reversible AE energy release accompanied the austenite-martensite transition process, which is in direct conflict with the 'Kaiser effect'. This observation implies that caution is necessary in applying the AE technique for evaluating failure in shape-memory alloys. The value derived from the AE data for the stress required to induce martensitic transformation and for the temperature at which the transformation is initiated are in good agreement with those obtained from stress-strain measurements. (8 refs.)

72055 Acoustical measurement of solid state non-linearity: application to $CsCdF_3$ and $KZnF_3$. M.A.Breazeale, J.Philip (Dept. of Phys., Univ. of Tennessee, Knoxville, TN, USA), A.Zarembowitch, M.Fischer, Y.Gesland.
J. Sound & Vib. (GB), vol.88, no.1, p.133-40 (8 May 1983).
Combination of the results of two sets of measurements on the same crystalline samples of $CdCdF_3$ and $KZnF_3$ has made possible the evaluation of the third-order elastic (TOE) constants of these two fluoroperovskites. In the first technique the hydrostatic pressure dependence of the velocity of ultrasonic waves of different propagation and polarization directions has been measured to determine three linear combinations of TOE constants. In the second technique the fundamental and the second harmonic amplitudes of an initially sinusoidal longitudinal ultrasonic wave of finite amplitude propagating along the principal directions have been measured to determine three other linear combinations. (33 refs.)

72056 Effect of the hydrogen tunnelling states of the acoustic wave propagation in niobium at low temperatures. G.Bellessa (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Lett. (France), vol.44, no.10, p.L387-91 (15 May 1983).
The variation of the sound velocity at 200 MHz has been measured down to 50 mK in single crystals of niobium doped with oxygen and hydrogen. An effect of the hydrogen tunnelling states on the sound velocity is reported. Some characteristic parameters of these states are then deduced. (16 refs.)

72057 Pressure dependence of the low temperature acoustic anomalies in vitreous silica. U.Bartell, S.Hunklinger (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.489-92 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The authors have measured the ultrasonic attenuation in quartz glass SUPRASIL W1 under high pressure (up to 4.2 kbar) down to temperature of 60 mK. At low temperatures (T<4K), contrary to their expectation, only a moderate increase of absorption (~25%) is observed. At higher temperature a strong rise of attenuation has been observed. (9 refs.)

72058 Connection between the low temperature acoustic properties and the glass transition temperature of fluoride glasses. P.Doussineau (Lab. d'Ultrasons, Univ. Pierre et Marie Curie, Paris, France), M.Matecki, W.Schon.
J. Phys. Colloq. (France), vol.43, no.C-9, p.493-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The variations of the velocity and the absorption of longitudinal and transverse acoustic waves have been measured in three fluoride glasses in the temperature range 0.1K to 1.5K. The density of states of two level systems (TLS) and the TLS-phonon coupling constants have been determined. The TLS density of states has been found to be inversely proportional to the glass transition temperature. (6 refs.)

72059 Ultrasonic study of lithium borate glasses. M.Devaud, J.-Y.Prieur (Lab. d'Ultrasons, Univ. Pierre et Marie Curie, Paris, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.497-500 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The authors present the results of an ultrasonic study of two fast ionic conducting glasses with compositions B_2O_3-0.5 Li_2O-0.7 LiCl and B_2O_3-0.5 Li_2O. The variation of the ultrasonic velocity is commented in structural terms. The comparison of the deduced values of the TLS parameters shows that they are independent of the composition. (5 refs.)

72060 Ultrasonic studies of some polymers at low temperatures. G.Federle, S.Hunklinger (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.505-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The sound velocity and acoustic absorption have been measured in polymethylmethacrylate (PMMA), polyethylmethacrylate (PEMA), and polycarbonate (PC) from 60 mK to 10K. For all three polymers similar acoustic properties are observed. At low temperatures, in contrast to earlier measurements, the authors find an absorption proportional to $\omega^0 T^3$ and a logarithmic variation of the sound velocity, as expected from the tunneling model. At higher temperature the absorption reaches a plateau. This is for the first time the plateau, predicted in the tunneling model, has been observed in an amorphous material. (7 refs.)

72061 Acoustic propagation in an epoxy resin at very low temperatures. P.Doussineau, W.Schon (Lab. d'Ultrasons, Univ. Pierre et Marie Curie, Paris, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.509-11 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The attenuation and velocity changes of longitudinal acoustic waves in the 150-2140 MHz range have been measured in an epoxy resin in the temperature range 0.1K to 10K. The behaviour usually seen in amorphous insulators were observed: in particular the T^3 variation of the attenuation at the lowest temperatures, logarithmic increase of the velocity. All the features are well explained in the framework of the TLS model. (7 refs.)

72062 Glass-like anomalies in the hypersonic properties of OH^- doped KCl crystals. R.Vacher, J.Pelous, J.F.Berret (Lab. de Spectrometrie Rayleigh-Brillouin, Univ. de Montpellier II, Montpellier, France), M.Schmidt.
J. Phys. Colloq. (France), vol.43, no.C-9, p.517-19 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Using the Brillouin scattering technique, the authors have measured the velocity and attenuation of 30 GHz longitudinal hypersonic waves down to 1K for OH^- doped KCl crystals: they present here the results for a sample with OH content of 0.5%. They have observed an absorption peak in the vicinity of 20K. At lower temperature, the attenuation increases with decreasing temperature. These results can be described by assuming a coupling of phonons with tunneling systems and thermally activated defects, related to OH^- impurities. (9 refs.)

Improved resonance technique for materials characterization ...See Entry 71320

Fast two-level systems in vitreous silica .... See Entry 71897

Structural changes in nickel after ultrasonic action with subthreshold amplitudes in liquid helium ....See Entry 71967

Low frequency elastic properties of glasses at low temperature ....See Entry 72046

Phonons in amorphous materials .... See Entry 72070

Study of the swelling of an Al-Ar-O alloy by an acoustic emission method ....See Entry 72142

'Current-free' amplification of hypersound in a planar configuration ....See Entry 72453

Infrared observation of intrinsic modes on adsorbent surfaces by photothermal beam deflection spectroscopy .... See Entry 72812

Brillouin scattering from amorphous polymers at low temperatures ....See Entry 72821

Light scattering from acoustic and low-frequency vibrational modes in borate glasses ....See Entry 72822

63.00 LATTICE DYNAMICS AND CRYSTAL STATISTICS

(see also 05.50 Lattice theory, 65. Thermal properties, 66.70 Thermal conduction, 68.30 Dynamics of surface and interface vibrations, 78.30 Infrared and Raman spectra)

63.10 GENERAL THEORY

72063 Bond dynamics in arbitrary lattices. D.C.Mattis (Phys. Dept., Univ. of Utah, Salt Lake City, UT, USA).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.101-3 (18 April 1983).
The author treats the quantum mechanics/dynamics of lattices in arbitrary dimensions, with arbitrary topology—whether crystalline or amorphous—whether elastic or inelastic. The method is a generalization of a transformation which has been successful for one- or two-dimensional structures, from site to bond coordinates. The author's formulation clarifies the role of defects in melting phenomena. (4 refs.)

63.20 PHONONS AND VIBRATIONS IN CRYSTAL LATTICES

72064 Concentration dependence of the local oscillation spectrum in V-Be α solutions. Yu.L.Shitikov, N.A.Chernoplekov, M.G.Zemlyanov, A.P.Zhernov (I.V. Kurchatov Inst. for Atomic Energy, Moscow, USSR).
J. Phys. C (GB), vol.16, no.13, p.2471-9 (10 May 1983).
Cold neutron inelastic scattering is used to investigate the dynamics of α solutions of Be in a V matrix for various concentrations. The increase of Be concentration leads to a broadening of the local oscillation (LO) spectrum and to a shift of its centre. The concentration dependence of the LO spectrum width and LO energy position, as well as the deformation of the lattice vibrations spectrum are compared with calculations in terms of the coherent potential approximation. (15 refs.)

72065 Excitation wavenumber dependence of the symmetric chain-stretching mode of linear-chain mixed-valence platinum complexes. R.J.H.Clark, M.Kurmoo (Christopher Ingold Labs., Univ. College London, London, England).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.519-27 (April 1983).
The wavenumber ν_1, of the symmetric chain-stretching mode of linear-chain halogen(X)-bridged mixed-valence complexes of platinum increases as the wavenumber of the excitation line (ν_0) increases, whereas those of equatorial modes do not. For any set of complexes the wavenumber change, $\nu_1(\lambda_0$=short wavelength)$-\nu_1(\lambda_0$=long wavelength), increases in the order Cl<Br<I and is largest for those complexes in which the $Pt^{II}...Pt^{IV}$ separation is least and for which the bond-length ratio $r(Pt^{IV}-X)/r(Pt^{II}-X)$ is nearest to unity. This suggests that the wavenumber dispersion of ν_1 with ν_0 depends on the extent of valence delocalisation along the chain. (18 refs.)

72066 One-dimensional quantum-spin-phonon solitons. A.Messina (Istituto di Fisica, Univ. degli Studi di Palermo, Palermo, Italy).
Phys. Rev. B (USA), vol.27, no.8, p.4665-83 (15 April 1983).
The quantum dynamics of a compressible harmonic chain of N two-level atoms strongly interacting with the phonons of the lattice is investigated. Two types of mixed excitons are discussed which propagate through the lattice exhibiting solitonic properties. The first type of solitonlike excitation describes the motion of the wall separating two magnetoelastic domains. This transports less energy than the second type of solitonlike excitation which describes the motion of a single spin reversal in the chain. An explicit expression is obtained for the speed of these excitations as a function of an appropriate shape parameter h. These results are obtained by approximate self-consistent integration of a system of nonlinear differential equations related to the Heisenberg equations of motion for atomic operators. (21 refs.)

Vibrational spectra of bromocyclopropane .... See Entry 70885

Structural relationships between spontaneous strain and acoustic properties in ferroelastics ....See Entry 72101

Quantum diffusion of atoms in a crystal. Localization and phonon-stimulated delocalization ....See Entry 72150

Lattice thermal conductivity of II-VI compounds ....See Entry 72175

Spin-lattice relaxation theory of excited triplet-state impurities in molecular crystals ....See Entry 72313

Spin aligned exciton gas in uniaxially compressed Ge ....See Entry 72324

Consideration of the vibrational properties of germanium dichalcogenides on base of vibrational properties of GeX_4 (X=S,Se) tetrahedra ... See Entry 72783

Raman studies of vibrational and reorientational relaxation in rotator phase perfluorocyclohexane .... See Entry 72793

Vibrational spectra of some rhenium-apatites containing ReO_5-groups ....See Entry 72808

Raman scattering in quasi-one-dimensional $ZrTe_5$ ....See Entry 72810

Studies of EPR, spin, and phonon kinetics in parametic ionic crystals using Mandel'shtam-Brillouin and Raman scattering of light ....See Entry 72817

Phonon selectivity in resonant Brillouin scattering (RBS) from multi-component polaritons ....See Entry 72824

Resonant Brillouin scattering in GaAs—linewidth measurements and the effect of stress ....See Entry 72825

Infrared absorption due to pair modes of the NO_2^- ions doped in KI single crystals ....See Entry 72841

Enhanced sensitivity of Ne atoms to inelastic scattering by bulk phonons with respect to He/LiF experiments .... See Entry 72922

63.20D Phonon states and bands, normal modes, and phonon dispersion

72067 Lattice dynamics of rhenium trioxide. E.V.Gabrusenok.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.66-8 (1983). In Russian.
The curves of phonon dispersion and the density of one-phonon states have been calculated for the rhenium trioxide crystal in the model of rigid ions. The model contains five parameters: four force constants $A_1=522.2$; $B_1=-90.3$; $A_2=24.1$; $B_2=11.5$ (N/m) and a charge of oxygen ion $Z_0=-1.13$ e. (8 refs.)

Glass-like anomalies in the hypersonic properties of OH^- doped KCl crystals . ...See Entry 72062

Strain-field scattering of phonons: some comments on papers by Kogure and Hiki ....See Entry 72068

Reply to the comment 'Strain-field scattering of phonons' ...... See Entry 72069

Specific heat of lead chalcogenides ....See Entry 72134

Vibrations in superlattices; application to GaAs-AlAs systems ....See Entry 72208

The vibration-quenching of the exciton and the Huang-Rhys factor in the quasi one-dimensional antiferromagnet CMC ....See Entry 72310

Temperature dependence of the low frequency Raman scattering spectra in tetramethylammonium tetrachlorozincate ....See Entry 72794

The Raman spectra of manganese and zinc fluorotitanate hexahydrate systems ....See Entry 72796

Raman scattering in GeS single crystals at low temperatures ..See Entry 72801

Polarized Raman spectra of InS single crystal ....See Entry 72802

Resonant Raman scattering in GaAlAs: first order active and disorder activated phonon lines. Theory of the IR dielectric susceptibility ....See Entry 72806

Infrared reflection spectra of gypsum ....See Entry 72809

Raman scattering in quasi-one-dimensional $ZrTe_5$ ....See Entry 72810

Anomalies in the anisotropy of Raman scattering by polar vibrations in CdP_2 crystals .... See Entry 72814

The structure of Raman scattering spectrum for phianite of 0.9 ZrO_2-0.1 Y_2O_3 composition .... See Entry 72815

The sequence of phases in Al-Cu alloys .... See Entry 73091

63.20H Phonon-phonon interactions

The relation between the heat current and the phonon drift velocity .... See Entry 69827

Multiphoton processes in light absorption by homopolar crystals. Self-trapping and classical solutions [for multiphoton read multiphonon] .... See Entry 72743

Large anisotropic vibrational correlations in *A*15 Nb_3Ge .... See Entry 72885

63.20K Phonon-electron interactions

The vibration-quenching of the exciton and the Huang-Rhys factor in the quasi one-dimensional antiferromagnet CMC .... See Entry 72310

Interaction of phonons with the electron-hole liquid .... See Entry 72323

Connection between the heat capacity and the effective mass of the electrons in Fermi-liquid theory at finite temperatures .... See Entry 72336

Theory of superconductivity in graphite intercalation compounds .... See Entry 72537

Calculation of λ for the quasi-one-dimensional superconductor V_3Si .... See Entry 72541

Multiphoton processes in light absorption by homopolar crystals. Self-trapping and classical solutions [for multiphoton read multiphonon] .... See Entry 72743

Resonance-Raman scattering and electron-phonon coupling in the cuprous halides .... See Entry 72807

Strong electron-phonon interaction effects in modulated transient reflectance spectra of $Ga_{.50}In_{.50}P$ .... See Entry 72832

Effect of electron-phonon interaction on the photoluminescence of single crystals of BiI_3 .... See Entry 72867

63.20M Phonon-defect interactions

72068 **Strain-field scattering of phonons: some comments on papers by Kogure and Hiki.** R.A.Brown (Jabatan Fizik, Univ. Pertanian Malaysia, Selangor, Malaysia).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1498-9 (April 1983).
Early calculations of phonon scattering by the strain fields of crystal imperfections employed drastic approximations which left the results uncertain. Important advances were made by Kogure and Hiki (see ibid., vol.36, p.1597, 1974, and ibid., vol.38, p.471, 1975) who combined an exact description of the (long-wave) phonon-strain interaction with realistic phonon dispersion relations. The author discusses corrections to the calculations of Kogure and Hike. (16 refs.)

72069 **Reply to the comment 'Strain-field scattering of phonons'.** Y.Kogure, Y.Hiki (Tokyo Inst. of Technol., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1500-1 (April 1983).
The authors reply to the comments of R.A. Brown (see ibid., vol.52, no.4, p.1498, 1983) on their previous work (see ibid., vol.36, p.1597, 1974, and ibid., vol.38, p.471, 1975). The topic is phonon scattering in anisotropic medium. The authors have previously developed a precise calculation of strain-field scattering of phonons in an anisotropic crystal and obtained a general formula for the strength of the scattering. The formula was applied to phonon scattering by a crystal dislocation.

Thermal conductivity of HgSe .... See Entry 72176

63.20P Localized modes

Direct evidence for the site of substitutional carbon in GaAs using localised vibrational mode spectroscopy .... See Entry 71983

Effect of the hydrogen tunnelling states of the acoustic wave propagation in niobium at low temperatures .... See Entry 72056

Incommensurate structures induced by an external field and the soft mode concept .... See Entry 72100

On the Mossbauer isomer-shift studies of the electronic structure of semiconductors .... See Entry 72722

Isotope shifts for the P, Q, R lines in indium-doped silicon .... See Entry 72865

63.50 VIBRATIONAL STATES IN DISORDERED SYSTEMS

72070 **Phonons in amorphous materials.** S.Hunklinger (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.461-74 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The study of the propagation of phonons is an important tool to investigate the sometimes unexpected and puzzling dynamic properties of amorphous solids. At first, as a typical example, the author discusses the acoustic properties of vitreous silica. In the second part of the review emphasis will be given to the anomalous low temperature properties of amorphous materials. (51 refs.)

72071 **Thermoelastic and relaxational properties of dielectric and metallic glasses at low temperature.** H.Tietje, M.von Schickfus, E.Gmelin (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.529-32 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The authors have investigated the low-temperature Gruneisen parameter and the long-time relaxational behaviour of the tunneling excitations in vitreous silica and in the metallic glass PdSiCu through the thermoelastic effect. In the case of a-SiO_2, the data agree qualitatively with previous measurements of the thermal expansion, and relaxation times of up to 600 s have been detected. For PdSiCu a large relaxational contribution was found. (6 refs.)

72072 **The effect of structural disorder on phonon lifetimes.** D.Walton, J.J.Vanderwal, H.C.Teh (Phys. Dept., McMaster Univ., Hamilton, Ontario, Canada).
J. Phys. Colloq. (France), vol.43, no.C-9, p.545-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The lifetimes of thermal phonons in fused silica have been measured using Brillouin spectroscopy. The results show that in addition to that due to two level systems there is a substantial contribution to the scattering which is temperature independent and is propably structural in origin. (9 refs.)

Local order in amorphous polystyrenes: a high-resolution ^{13}C-NMR study .... See Entry 71908

Connection between the low temperature acoustic properties and the glass transition temperature of fluoride glasses .... See Entry 72058

Bond dynamics in arbitrary lattices .... See Entry 72063

Evaluation of the intermolecular specific heat of quasi-spherical molecular liquids from thermo-acoustic data .... See Entry 72132

The empirical correlations between phonon spectrum parameters λ, ⟨ω⟩, ⟨ω^2⟩ and the Hall coefficients of amorphous superconductors .... See Entry 72529

An examination of the longitudinal acoustic mode of polyethylene crystals (Raman spectra) .... See Entry 72799

Brillouin scattering from amorphous polymers at low temperatures .... See Entry 72821

Light scattering from acoustic and low-frequency vibrational modes in borate glasses .... See Entry 72822

63.70 STATISTICAL MECHANICS OF LATTICE VIBRATIONS

(see also 65. Thermal properties of condensed matter, 66.70 Thermal conduction)

72073 **On the Debye-Waller factor of BCC transition metals.** A.R.Jani, V.B.Gohel (Dept. of Phys., Sardar Patel Univ., Gujarat, India).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.469-78 (April 1983).
Debye-Waller factors at different temperatures for six BCC transition metals have been calculated on the basis of a screened shell phenomenological model proposed by the authors. Comparison of theoretical values with the existing experimental data is made and discussed. The computed values for X-ray characteristic temperatures (Θ_M) are also compared with those resulting from general force constant models determined by inelastic neutron scattering experiments. (66 refs.)

72074 **X-ray determination of the mean-square atomic displacement and associated Debye temperature of erbium.** N.Gopikrishna, D.B.Sirdeshmukh (Dept. of Phys., Kakatiya Univ., Warangal, India).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K105-8 (1 April 1983).
The results of an X-ray determination of the Debye-Waller factors, RMS amplitudes of vibration, and the Debye temperature are reported. The value obtained by the X-ray method is found to be lower than that from specific heat and also from elastic constant. (8 refs.)

Volume dependence of the melting temperature for alkali metals with Debye's model .... See Entry 72084

Thermophysical properties of the intermetallic Mn_3MN perovskites. I. Heat capacity of the manganese nitride Mn_4N .... See Entry 72133

Specific heat of lead chalcogenides .... See Entry 72134

Mossbauer spectroscopy of laser annealed tellurium implanted silicon. I. ^{119}Sn and ^{125}Te .... See Entry 72720

Mossbauer spectroscopy of laser annealed tellurium implanted silicon. II. ^{129}I .... See Entry 72721

Large anisotropic vibrational correlations in *A*15 Nb_3Ge .... See Entry 72885

Atom scattering by soft-potential surfaces with one-Rayleigh-phonon exchange .... See Entry 72925

63.75 STATISTICAL MECHANICS OF DISPLACIVE PHASE-TRANSITIONS

(for order-disorder and statistical mechanics of model systems, see 64.60; for crystallographic aspects of polymorphic and order-disorder transformations, see 61.50K)

The structure of Cr-Al alloys exhibiting anomalous physical properties .... See Entry 71930

63.90 OTHER TOPICS IN LATTICE DYNAMICS AND CRYSTAL STATISTICS

Optical properties of K_2SeO_4 in the vicinity of phase transitions .... See Entry 72753

Analysis of the soft mode behaviour in $Li_2Ge_7O_{15}$ in terms of a coupled-mode model .... See Entry 72789

64.00 EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS

(see also 82.60 Chemical thermodynamics)

64.10 GENERAL THEORY OF EQUATIONS OF STATE AND PHASE EQUILIBRIA

Thermodynamic evaluation of mixed working fluids .... See Entry 72138

64.30 EQUATIONS OF STATE OF SPECIFIC SUBSTANCES

(see also 65.70 Thermal expansion)

72075 Application of an approximate form of spacing statistics to the high-temperature thermodynamic properties of UO_2. L.Manes, V.Dallacasa, B.Leonardis (Commission of the European Communities Joint Res. Centre, Karlsruhe Establ., European Inst. for Transuranium Elements, Karlsruhe, Germany).
High Temp.-High Pressures (GB), vol.14, no.4, p.449-63 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
A short survey of spacing statistics is given. It is shown that an equation of state derived by use of these statistics predicts properties at the triple and critical points of many elements and compounds which are in reasonable agreement with experimental data. The method has been applied to uranium dioxide. (13 refs.)

72076 Thermodynamic properties of liquid thorium monocarbide up to the critical point. G.Gigli, M.Guido, G.De Maria (Istituto di Chimica Fisica, Univ. di Roma, Rome, Italy).
High Temp.-High Pressures (GB), vol.14, no.4, p.465-75 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
The equation of state of liquid thorium monocarbide has been evaluated by an application of the significant structures theory, which takes into account the complex vaporization behaviour of this substance. In addition to the critical parameters and the thermodynamic properties along the liquid-vapour line a representation of the pressure-internal-energy relationship is given for a wide range of densities. (29 refs.)

64.60 GENERAL STUDIES OF PHASE TRANSITIONS

(for critical phenomena in quantum fluids, superconductors, magnetic materials and ferroelectrics, see 67., 74.40, 75.40 and 77.80 respectively)

72077 Algebraic investigations in Landau model of structural phase transitions. I. Group lattices and lattices of stability spaces. V.Kopsky (Inst. of Phys., Czechoslovak. Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.485-509 (1983).
An abstraction from actual physical situations and from the meaning of parameters which appear in the phase transition theory leads to an algebraic study, the main object of which are the group-subgroup relations and the subduction of the identity representation. Subgroups of the initial group G form an algebraic structure called the lattice of the group G. To a symmetry descent from G to its subgroup F there corresponds an onset of those variables which belong to the stability space of the group F. It appears that these stability spaces form a lattice dual to the lattice of the group G. An important concept of exomorphism of group-subgroup relations is introduced and analysed. If two symmetry descents (group-subgroup relations) $G|F$ and $\bar{G}|\bar{F}$ are exomorphic, then all aspects of the subduction of the identity representation are quite similar in both cases. The group lattices and lattices of stability spaces as well as all the exomorphic types of group-subgroup relations within the crystal point groups are given in appendix. (24 refs.)

72078 Fluctuations in the interface between two phases. F.Schlogl, C.Escher (Inst. fur Theoretische Phys., Tech. Univ., Aachen, Germany), R.S.Berry.
Phys. Rev. A (USA), vol.27, no.5, p.2698-704 (May 1983).
In continuation of an earlier paper [F. Schlogl and R.S. Berry, Phys. Rev. A 21, 2078 (1980)] (referred to as I), small fluctuations in the interface between two phases will be discussed and with this an error in I will be corrected. The dynamics of the fluctuations is connected with the quantum mechanics of the modified Poschl-Teller potential. Moreover, the fluctuations in the solitary solution of a moving surface are studied and also brought into connection with a quantum-mechanical system. The regression spectrum of these fluctuations is discussed in dependence on the velocity of the interface. If this velocity exceeds a certain value, the character of the regression to the kink profile changes qualitatively. (6 refs.)

72079 Undercooling behavior of liquid metals. J.H.Perepezko, J.S.Paik (Dept. of Metall. & Mineral Engng., Univ. of Wisconsin-Madison, Madison, WI, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.49-63
The undercooling of liquid metals is often observed, but is restricted by the catalysis of the most potent heterogeneous nucleation site in contact with the liquid. An experimental approach that yields large undercoolings involves the slow cooling from the melt of a dispersion of stabilized fine liquid droplets. Droplet studies have extended measurements of the undercooling limit for low melting point metals to the range of 0.3 to 0.4 T_m. In droplets, surface coating and size characteristics usually limit the undercooling and control the uniformity of crystallization behavior. A nonuniform undercooling behavior can produce microstructural variations in powder samples with respect to metastable phases and solute segregation, but these variations can be diminished for isenthalpic solidification of hypercooled liquids. In alloys, the trend in nucleation temperature can follow a similar pattern as the composition dependence of the liquidus. With highly undercooled droplets, and even at modest ΔT with known heterogeneous sites, structural modifications such as extended solid solutions and metastable intermediate phases can be generated which are similar to those produced by rapid quenching techniques. These features highlight the importance of a high liquid undercooling as well as a high cooling rate in promoting effective rapid solidification processing treatments. (25 refs.)

Huckel and Mobius boundary conditions for solids and orbital symmetry correlation in the rotational phase transition of molecular crystals .... See Entry 71911

Modification of the pair approximation of the quasi-chemical ordering theory of binary systems .... See Entry 71920

Solidification mechanism of highly undercooled metal alloys ... See Entry 72089

Free energy expansion for the two-component order parameter .... See Entry 72097

Critical wetting in three dimensions .... See Entry 72184

Critical dynamics at the percolation threshold by fractal and scaling approaches .... See Entry 72628

64.70 PHASE EQUILIBRIA, PHASE TRANSITIONS, AND CRITICAL POINTS

(see also 81.30 Phase diagrams and microstructures developed by solidification and solid-solid phase transformations)

72080 Comment on 'nomenclature and geometrical representation of invariant equilibria in multicomponent systems [and reply]. A.Prince (General Electric Co., Hirst Res. Center, Wembley, England), N.Kanani, J.Lohberg.
Z. Metallkd. (Germany), vol.74, no.5, p.338 (May 1983). In English, German.
Comments are made on a paper by Lohberg and Kanani (see ibid., vol.73, p.619, 1982). It seems doubtful whether the approach of Lohberg and Kanani advances the representation of multicomponent invariant equilibria and their associated monovariant equilibria. Invariant reactions are classified as belonging to three types: invariant formation equilibrium: invariant decomposition equilibrium and invariant transition equilibrium. This classification is unnecesary. The generalised invariant equilibrium for isobaric sections of n-component systems, which contain $(n+1)$ phases, can be represented in the following form: ${}_{\phi 1}+{}_{\phi 2}+\ldots{}_{\phi i-1}+\leftrightarrows{}_{\phi i+1}+\ldots+{}_{\phi n}+{}_{\phi n}+{}_{1}$. For i=n, an invariant formation equilibrium is established. For $i=1$, an invariant decomposition equilibrium is established. Kanani and Lohberg reply stating that it does not matter which type of distribution is chosen, as long as there is agreement. They also point out that Prince's equation are not mathematically correct. (2 refs.)

A theoretical analysis of the phase-decompositions based upon the non-linear diffusion equation .... See Entry 73064

Formation of rutile type solid solutions in pseudobinary systems SnO_2-ABO_4 (A=Ga, Cr; B=Nb, Ta, Sb^{5+}) and SnO_2-AB_2O_6 (A=Mg, Zn; B=Sb^{5+}) .... See Entry 73065

Diagram of state for the Yb-Ge system .... See Entry 73066

Phase equilibria in iron ternary systems. V. Critical evaluation of constitutions of certain ternary alloys containing iron, tungsten, and a third metal. [addendum] .... See Entry 73067

Calculation of the liquidus surface of the Ti-Mo-Al system .... See Entry 73068

Phase equilibria in the Sm-Re-B system .... See Entry 73069

A thermodynamic analysis of the tin-tellurium system and calculation of the phase diagram .... See Entry 73070

Stable and metastable phase relations in the system ZrO_2-CaO .... See Entry 73071

Phase relations and ordering in the systems MgO-Y_2O_3-ZrO_2 and CaO-MgO-ZrO_2 .... See Entry 73072

The correlation of the thermodynamic properties of wustite by a gaussian based formalism .... See Entry 73073

Considerations of solute-drag in relation to transformations in steels .... See Entry 73081

Transmission electron microscopy of an annealed and nitrided Fe-600 wt.ppm Ti alloy .... See Entry 73116

On γ and γ' phases composition in Ni-base superalloys after high-temperature exposure .... See Entry 73117

64.70D Solid-liquid transitions

(see also 81.30F Solidification)

72081 Heat of crystallization and melting point of amorphous silicon. E.P.Donovan, F.Spaepen, D.Turnbull (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA), J.M.Poate, D.C.Jacobson.
Appl. Phys. Lett. (USA), vol.42, no.8, p.698-700 (15 April 1983).
Thin layers of amorphous silicon (a-Si) were produced by noble gas ion implantation of (100) substrates held at 77K. Rutherford backscattering and channeling, and differential scanning calorimetry were used to measure the heat of crystallization, ΔH_{ac}, to be 11.9 ± 0.7 kJ/mol, substantially less than the value predicted by scaling ΔH_{ac} of a-Ge. The crystal growth velocity is found to have the form $\nu=\nu_0\exp(-2.24\text{ eV/kT})$. The authors obtain a new estimate, 1420K, for the melting temperature of a-Si. (26 refs.)

72082 Direct observation of time-temperature-transformation curves for crystallization of ice from solutions by a homogeneous mechanism. D.R.MacFarlane, R.K.Kadiyala, C.A.Angell (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA).
J. Phys. Chem. (USA), vol.87, no.7, p.1094-5 (31 March 1983).
Emulsified samples of aqueous solutions of lithium chloride have been rapidly cooled to temperatures in the vicinity of the 'homogeneous nucleation temperature' T_g and observed isothermally in a differential calorimeter to identify the time delay before the maximum crystallization rate (detected by the release of the heat of crystallization) is achieved. The locus of the times t_p to reach the maximum rate at different temperatures has the classic form of the time-temperature-transformation (TTT) curve described in theories of homogeneous nucleation and growth. The displacement of this TTT curve to longer times and lower temperatures can be observed by increasing the solution concentration. The results correlate well with much longer time observations made recently with electrical conductivity studies of thin bulk samples near their glass transition temperature. (13 refs.)

72083 Melting and crystallisation on a corrugated surface. P.Vashista (Argonne Nat. Lab., Argonne, IL, USA), R.K.Kalia, J.J.Quinn.
J. Phys. C (GB), vol.16, no.13, p.L405-10 (10 May 1983).
Melting and crystallisation of a triangular electron solid on a commensurate, sinusoidally corrugated surface (of wavelength $\lambda=\sqrt{3}a/2$, a=lattice spacing) are studied by the molecular dynamics method. If the height of the corrugation $U_0$is less than a certain critical value U_c, melting is found to be a grain-boundary-mediated first-order transition. However, for $U_0>U_c$ the transition is continuous and induced by a small density of defects. (20 refs.)

72084 Volume dependence of the melting temperature for alkali metals with Debye's model. T.Soma, H.-M.Kagaya, M.Nishigaki (Dept. of Appl. Phys. & Math., Akita Univ., Akita, Japan).
Phys. Status Solidi b (Germany), vol.116, no.2, p.673-6 (1 April 1983).
Using the volume-dependence of the Gruneisen constant at higher temperatures, the volume effect on the melting temperature of alkali metals is studied by Lindeman's melting law and Debye's model. The obtained melting curve increases as function of the compressed volume and shows the maximum of the melting point at the characteristic volume. The resultant data are qualitatively in agreement with the observed tendency for alkali metals. (10 refs.)

72085 Mechanisms for melting. S.T.Chui (Bartol Res. Found., Franklin Inst., Univ. of Delaware, Newark, DE, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.29-42
Melting is one of the most general phenomena that is not completely understood. Much interest is revived in this subject recently because of the belief that topological defects may play a significant role. The effect of these topological defects is simpler to treat in two dimensions (2D) and this is the focus of the present review. The author also comments on the situation in three dimensions (3D) and the question of glasses at the end. (28 refs.)

72086 Melting and freezing in two dimensions: a molecular dynamics study. P.Vashishta, R.K.Kalia (Argonne Nat. Lab., Argonne, IL, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.43-73
Using the molecular dynamics technique, the authors have investigated the nature of melting and freezing transitions as well as structural and dynamical properties of liquid and solid phases in two-dimensional systems interacting via $1/r$ and $1/r^3$ potentials. From the velocity autocorrelation function (VAF) and dynamic structure factor for the electron liquid, it is shown that the well-defined oscillations in VAF are due to a coupling between the single particle motion and longitudinal excitations of wavevector on the order of the inverse interparticle separation. (54 refs.)

72087 Melting, order, flows, mappings and chaos. M.E.Fisher, D.A.Huse (Baker Lab., Cornell Univ., Ithaca, NY, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.259-93
A difficulty in reliably diagnosing continuous melting transitions via canonical simulations is pointed out and illustrated by the model of hard hexagons on a plane triangular lattice; finite-sized realizations at fixed density may well exhibit coexisting ordered and disordered peaks in phase space even when the transition is continuous in the thermodynamic limit. The role of flows and mappings in the theory of phase transitions is discussed. The nature of the phase diagrams in model systems displaying spatially modulated order and commensurate-incommensurate transitions is emphasized and some recent developments are reviewed briefly. (71 refs.)

72088 Growth kinetic limitations during rapid solidification. W.J.Boettinger (Metall. Div., NBS, Washington, DC, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.15-31
The importance of growth kinetics in the development of the microstructure of rapidly solidified alloys is described. Growth kinetics are conveniently divided into diffusion kinetics and interface attachment kinetics. The former, which are used extensively for the analysis of slow rate solidification, can be extended to high solidification rates to predict some microstructural features; e.g., the limitations on eutectic growth rate which can promote the formation of a metallic glass, and the reduction of microsegregation. At the highest rates, interface attachment kinetics must be included. Some microstructural effects of the velocity dependence of the partition coefficient are described. (60 refs.)

72089 Solidification mechanism of highly undercooled metal alloys. Y.Shiohara, M.G.Chu, D.G.MacIsaac, M.C.Flemings (MIT, Cambridge, MA, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.65-9
Describes the results of experiments on metal droplet undercooling, and presents a preliminary analysis of the structures obtained. Work was conducted with Sn-25 wt.%Pb and Ni-34 wt.%Sn alloys. To achieve the required high degrees of undercooling, emulsification treatments were utilized. Experiments show the fraction of supersaturated primary phase is found to be a function of the amount of undercooling, as is the fineness of the structures. The solidification behavior of the tin-lead droplets during recalescence was analyzed using three different hypotheses; 1) solid forming throughout recalescence is of the maximum thermodynamically stable composition, 2) partitionless solidification below the 'T_0' temperature, and solid forming thereafter is of the maximum thermodynamically stable composition, and 3) partitionless solidification below the 'T_0' temperature with solid forming thereafter that is of the maximum thermodynamically metastable composition that is possible. (7 refs.)

72090 Morphological stability of electron beam melted aluminum alloys. R.J.Schaefer, S.R.Coriell, R.Mehrabian, C.Fenimore, F.S.Biancaniello (NBS, Washington, DC, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.79-89
For constant velocity solidification, morphological stability theory delineates the temperature gradients required for plane front solidification of a specific alloy. Using electron beams, surface heating of metals can be carried out with sufficiently well characterized thermal input to permit reliable use of computer models of melting and solidification. From numerical calculations, the growth velocity and temperature gradients as a function of position during resolidification can be obtained; combining these results with morphological stability theory indicates the resolidification regimes for which the plane front is unstable. Presumably, completely planar solidification may be attained by selecting heating modes such that the region of instability is totally avoided, but the expected interface morphology is more difficult to predict if the interface passes briefly through an unstable region and then re-enters a region of stability. Aluminum-silver and aluminum-manganese alloys were melted under an electron beam with particular emphasis on attaining solidification sufficiently rapidly to satisfy the gradient-independent absolute stability condition. The velocities required to produce stability were considerably larger than expected. (11 refs.)

72091 A molecular orbital model of melting and glass formation. M.E.Eberhart, K.H.Johnson, R.C.O'Handley (MIT, Cambridge, MA, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.103-8
SCF-Xα-SW calculations have been performed on the glass forming crystal of Ni_2B. The resulting molecular orbital topology near the Fermi level is similar to that previously obtained by SCF-Xα-SW calculation on the glass forming crystals of Pd-Si and Cu-Zr. These similarities, it is conjectured, indicated melting is an electronically driven phase transition and that liquid and glass structures are more the result of electronic than kinetic factors. It is shown that the molecular orbital model of melting in transition metals generates structures similar to those resulting from the dense random packing of hard spheres method, and the molecular orbital mechanism admits, in a qualitative way, the explanation of a broad range of liquid and glass properties. (12 refs.)

Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium .... See Entry 69788

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting .... See Entry 69790

Computer simulation of the phases of two-dimensional Lennard-Jonesium: evidence for first-order transitions .... See Entry 71862

Glass-forming ability of the melt-quenched $(Fe_{1-y}Ni_y)_3B$ alloys .... See Entry 71883

Small volume change on melting as a new criterion for easy formation of metallic glasses .... See Entry 71899

Direct measurement of the melt depth of silicon during laser irradiation .... See Entry 72005

Undercooling behavior of liquid metals .... See Entry 72079

Some aspects of the miscibility behavior of polyester/halogenated polymer blends .... See Entry 72125

Ostwald ripening in two phase mixtures with application to rapid solidification .... See Entry 72128

Influence of solidification parameters on the microstructure of rapidly quenched Fe-Ni-B alloys .... See Entry 72131

A Raman spectroscopic study of the plastically crystalline state of organic compounds .... See Entry 72782

Control over the structure of hard metals and other heterophase materials produced by liquid-phase sintering. I. Liquid-phase migration and general principles of sintering of 'skeletonless' alloys .... See Entry 73020

Analysis of in situ rapid solidification of submicron Al-Ge eutectic powders using transmission electron microscopy .... See Entry 73025

The ternary system CaF_2-CdF_2-CrF_3. Dimorphism of $CaCrF_5$ and CrF_3 .... See Entry 73074

Some physical aspects of unidirectional crystallisation in microgravity .... See Entry 73075

Microsegregation and extended solid solutions after rapid solidification of aluminium alloys .... See Entry 73076

Formation and stability of extended solid solutions made by rapid quenching from the melt .... See Entry 73077

Rapid solidification of metastable materials .... See Entry 73078

Rapid solidification—mechanisms, morphology and microstructure .... See Entry 73079

Microsegregation of an aluminum and magnesium alloy at high solidification rates .... See Entry 73094

Influence of the type of solidification of a cast nickel alloy of the ZhS6 family on its high temperature strength .... See Entry 73211

64.70F Liquid-vapour transitions

72092 Interpretation of laser pulse heating experiments for determination of vapour pressures of nuclear fuel materials at high temperatures. J.Magill, C.Cercignani, R.W.Ohse (Commission of the European Communities Joint Res. Centre, Karlsruhe Establ., European Inst. for Transuranium Elements, Karlsruhe, Germany).
High Temp.-High Pressures (GB), vol.14, no.4, p.441-8 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
A theoretical analysis is presented of the different measurement techniques (depth measurement, recoil, and Mach disk techniques) used to determine the high-temperature saturated vapour pressure of nuclear fuel materials UO_2, $(UPu)O_2$, and UC by the laser pulse heating method. It is shown that the use of the Hertz-Knudsen equation relating the rate of evaporation to the saturated vapour pressure is basic to each of the three techniques, and that this equation is used as a boundary condition in the gas dynamic modelling of the structure of the vapour jet. The particular gas dynamic models used are analysed in detail and conclusions are drawn on the relative merits of the individual techniques. (14 refs.)

Computer simulation of the phases of two-dimensional Lennard-Jonesium: evidence for first-order transitions .... See Entry 71862

Thermodynamic properties of liquid thorium monocarbide up to the critical point .... See Entry 72076

64.70H Solid-vapour transitions

72093 High-temperature vaporization and thermodynamics of the titanium oxides. XVII. Approximate oxygen potentials in metal-rich solutions. B.Granier, P.W.Gilles (Dept. of Chem., Univ. of Kansas, Lawrence, KS, USA).
High Temp.-High Pressures (GB), vol.14, no.4, p.383-6 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
Measures the oxygen potential in metal-rich titanium-oxygen alloys at much higher temperatures than have been previously used, as a preliminary to an investigation at even higher temperatures with liquid samples. Samples with normal compositions in the range O/Ti=0.065-0.851 were prepared by arc melting. Vaporization was studied in a single-focusing mass spectrometer in which the intensities of TiO^+ and Ti^+ were measured at different temperatures in the range 1693-1893K for each of four samples, by use of a computer-based data-acquisition and equipment-control system. Approximate pressures of TiO(g) and Ti(g) were obtained from the measurements, and the approximate monatomic oxygen potentials, as obtained from the ratios of these pressures and known thermodynamic values, are of the order of 10^{-17} atm. (11 refs.)

72094 High-temperature vaporization of calcium oxide. T.Sata, T.Sasamoto, K.Matsumoto (Res. Lab. of Engng. Materials, Tokyo Inst. of Technol., Yokohama, Japan).
High Temp.-High Pressures (GB), vol.14, no.4, p.399-408 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
Langmuir vaporization of CaO in vacuum was measured at 1500-1900°C; vapour pressures of the main species Ca(g) were obtained. The vaporization coefficient was found to be almost unity up to 1800°C. Vaporization of CaO in O_2-Ar atmospheres containing H_2O vapour was measured at 1405-1743°C by means of the transpiration method. It was concluded that the main species under these conditions was $Ca(OH)_2(g)$. The equilibrium constant, K_p, and standard enthalpy change for the reaction $CaO(s)+H_2O(g)\rightleftharpoons Ca(OH)_2(g)$ were calculated. From these values, a dissociation energy for $Ca(OH)_2(g)$ of

206.4 kcal mol^{-1} was obtained, and it agreed well with values obtained from flame spectrometry. Four sets of vapour pressures for Ca(g), CaO(g), CaOH(g), and $Ca(OH)_2$(g) over CaO(s) are shown for four different combinations of $P(O_2)$ and $P(H_2O)$. (16 refs.)

72095 New pulse counting method for the improvement of the sensitivity and precision of vapour-pressure measurements. M.Yamawaki, M.Yasumoto, C.Nakano (Res. Center for Nuclear Sci. & Technol., Univ. of Tokyo, Tokyo, Japan), M.Kanno.
High Temp.-High Pressures (GB), vol.14, no.4, p.423-30 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
A method for pulse counting by the modulation of neutral beams has been developed to improve the sensitivity of the measurement of vapour pressures. This system can compensate for background pulses in intervals as short as 8 ms, so that the detection limit of vapour pressure has been improved by more than two orders of magnitude compared with the conventional DC method. A new method of measuring electron-multiplier counting efficiency has also been developed to improve the precision of the measurements. This method makes use of a pulse-height analyser and a Faraday cup. With this system, the counting efficiencies of H_2^+ and H_2O^+ ions were found to have a value of ~1.1, while those of the other atomic vapour species were close to unity at an incident ion energy higher than ~7 keV. (6 refs.)

Theoretical formulation of occurrence of microclusters from supersaturated metal vapour in cold inert gas .... See Entry 71046

Evaporation instability and surface oxidation of a solid under irradiation .... See Entry 73254

Predictive calculations of volatilities of metals and oxides in steam-containing environments .... See Entry 73267

64.70J Liquid-liquid transitions

72096 Phase transition in a solution of heteropolymers. E.S.Nikomarov (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.310-15 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.564-75 (Aug. 1982). [received: May 1983]
A two-field model is set up which describes a binary solution of linear heteropolymers in chemical equilibrium. The region of low concentrations and large mean molecular lengths is investigated. It is shown by the renormalization group method that in first-order approximation in ϵ a phase transition of first order in the monomer activity occurs in the solution. It is also shown that a sufficiently long heteropolymer molecule in such a solution forms a globule. Results are presented of calculations for a solution containing cyclopolymers. (9 refs.)

Computer simulation of the phases of two-dimensional Lennard-Jonesium: evidence for first-order transitions .... See Entry 71862

Small-angle neutron scattering from an oil-in-water microemulsion as a function of temperature .... See Entry 73372

64.70K Solid-solid transitions

(see also 61.50K Crystallographic aspects of polymorphic and order-disorder transformations, 81.30H, 81.30K, 81.30M Microstructures developed by solid-solid phase transformations)

72097 Free energy expansion for the two-component order parameter. R.Sikora (Inst. of Math. & Phys., I. Lukasiewicz Tech. Univ., Rzeszow, Poland), K.Parlinski.
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.479-84 (April 1983).
An analysis of the free energy expansion from the point of view of the first order structural phase transition is performed. The external lines along which the order parameter changes and the expansions of the free energy along these lines are given. (7 refs.)

72098 Order-disorder transitions and solid state reaction kinetics in Na_2SO_4-K_2SO_4 system. I. M.S.Kumari, E.A.Secco (Dept. of Chem., St. Francis Xavier Univ., Antigonish, NS, Canada).
Can. J. Chem. (Canada), vol.61, no.3, p.594-8 (March 1983).
The physicochemical aspects of the order-disorder phase transitions occurring in the Na_2SO_4-K_2SO_4 system were investigated by thermal analyses, infrared absorption, and X-ray diffraction methods. Kinetic and structural studies on the compounds $KNaSO_4$ and $K_3Na(SO_4)_2$ are reported in more detail. (19 refs.)

72099 Electrical conductivity and phase transition studies on pure and doped (Cd^{2+}, Gd^{3+}) $KNaSO_4$ and $K_3Na(SO_4)_2$. II. M.S.Kumari, E.A.Secco (Dept. of Chem., St. Francis Xavier Univ., Antigonish, NS, Canada).
Can. J. Chem. (Canada), vol.61, no.3, p.599-601 (March 1983).
For pt.I see ibid., vol.61, no.3, p.594-8 (1983). Electrical conductivity measurements on pure and doped $KNaSO_4$ and $K_3Na(SO_4)_2$ reveal high ionic conductivity values in the high temperature phase. High conductivity values ascribed to Na^+ resemble a superionic or fast-ion conductor. (12 refs.)

72100 Incommensurate structures induced by an external field and the soft mode concept. I.M.Vitebskii (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.468-71 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The soft mode concept is used to study the situation when the appearance of a long-period incommensurate structure in an external field is unavoidable on the basis of general symmetry considerations. Two qualitatively different possibilities are considered and these occur in the case of random and special orientations of an external field relative to the crystallographic axes. The symmetry aspects of the influence of an external field on an incommensurate structure are considered for the case when such a structure forms as a result of a second-order transition from a homogeneous phase. (5 refs.) *A.T.*

72101 Structural relationships between spontaneous strain and acoustic properties in ferroelastics. W.I.F.David (Clarendon Lab., Oxford Univ., Oxford, England).
J. Phys. C (GB), vol.16, no.13, p.2455-70 (10 May 1983).
A number of structural relationships between the spontaneous strain and acoustic properties of ferroelastic materials is described. Zero-velocity pure transverse acoustic modes are shown to occur in mutually perpendicular pairs at second-order phase transitions. These soft modes have propagation and displacement directions situated in ferroelastic domain wall planes. The resultant ferroelastic spontaneous strain is shown to result from the appropriate summation of pure shear strains produced by these soft modes and characterised by a two-dimensional acoustic strain tensor which is proportional to the difference between the spontaneous strain tensors of two strain-compatible ferroelastic orientation states. (24 refs.)

72102 Short-range-order parameters for a binary alloy on the FCC lattice. S.McKenzie (Dept. of Chem., Royal Holloway Coll., Univ. of London, Egham Hill, England).
J. Phys. C (GB), vol.16, no.13, p.2509-15 (10 May 1983).
Short-range-order parameters are calculated for a binary alloy of composition AB on the face-centred cubic lattice. Monte Carlo simulation techniques are used to obtain estimates for these parameters for the first ten coordination shells. The results are compared with those predicted by other approaches and excellent agreement is obtained with series predictions for the Ising ferromagnet. (15 refs.)

72103 Effect of uniaxial compression on the ferroelastic phase transitions in layered $KSc(MoO_4)_2$. L.N.Pelikh (Physicotech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1782-3 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3145-7 (Oct. 1982). [received: April 1983]
The author reports the results of a study of the effect of uniaxial compression of the $KSc(MoO_4)_2$ crystal on the temperature of the ferroelastic phase transitions. The $KSc(MoO_4)_2$ crystals were grown by the method of spontaneous crystallization from a molten solution of $K_2Mo_2O_7$. The transition to the ferrophase was detected from the anomalies in the dielectric constant ϵ. The measuring electric field (1000 Hz) and the pressure P were applied parallel to the C_3 axis, perpendicular to the layers. (8 refs.)

72104 A new molecular dynamics method for the study of crystal structure transformations. M.Parrinello (Istituto di Fisica Teorica, Trieste, Italy), A.Rahman.
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.97-109
Recent developments in the theory of molecular dynamics have allowed the modeling on the computer of solid to solid phase transitions. A review of this theory is given, and its applications to a variety of physical systems are briefly described. (17 refs.)

Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium .... See Entry 69788

Modification of the pair approximation of the quasi-chemical ordering theory of binary systems .... See Entry 71920

Synthesis and characterisation of the crystalline phases of the system PbF_2-ZrF_4 .... See Entry 71950

Intergrowths and defect structures in $Bi_9Ti_3Fe_5O_{27}$ revealed by high-resolution electron microscopy .... See Entry 71954

An investigation of order/disorder in a chromia-doped rutile by high-resolution electron microscopy .... See Entry 71980

Elastic anomaly in $LiKSO_4$ crystals .... See Entry 72029

Elastic-constant anomalies in metallic superlattices: a molecular-dynamics study .... See Entry 72031

Acoustic emission measurements of a shape-memory alloy .... See Entry 72054

Melting, order, flows, mappings and chaos .... See Entry 72087

Surface states of metastable $(GaAs)_{1-x}Ge_{2x}$ alloys .... See Entry 72464

Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy .... See Entry 72638

Magnetostriction of austenite in iron-nickel-manganese alloys and martensitic transition under the action of a strong magnetic field .... See Entry 72649

NMR study of solid perfluorocyclobutane .... See Entry 72693

Molecular reorientations of 1-bromo- and 1-iodo-adamantanes—^1H NMR relaxation study .... See Entry 72694

Optical absorption in single-crystal metastable $(GaAs)_{1-x}(Ge_2)_x$ alloys; evidence for a zinc-blende-diamond order-disorder transition .... See Entry 72752

Vibrational spectroscopy at high pressures. XLI A Raman study of manganese rhenium decacarbonyl .... See Entry 72785

Temperature dependence of the low frequency Raman scattering spectra in tetramethylammonium tetrachlorozincate .... See Entry 72794

The problem of cerium .... See Entry 72968

Hot-pressed silicon nitride with a small amount of MgO added .... See Entry 73039

High-temperature X-ray investigation of conversion of cementite into austenite .... See Entry 73080

Influence of hydrogen on the temperature of a thermoelastic martensitic transformation in titanium nickelide .... See Entry 73082

A transformation anomaly in a Cu-Zn-Al alloy .... See Entry 73083

Characteristic martensitic transformation of the Fe-Pt disordered alloys around the γ-α phase boundary .... See Entry 73084

Influence of two-stage ageing on structural transitions in β-zirconium alloys .... See Entry 73086

Analysis of the characteristics of lumped deformation of heterophase crystalline materials .... See Entry 73135

Plastic deformation of a metastable stainless steel at low temperatures .... See Entry 73161

64.70M Transitions in liquid crystals

72105 I-N-A phase diagrams of liquid crystals. Shu Chang-qing, Lin Lei (Inst. of Phys., Acad. Sinica, Beijing, China), Wang Liang-yu.
Commun. Theor. Phys. (China), vol.1, no.1, p.107-10 (1982).
The isotropic liquid (I) ⊥ nematic (N) ⊥ smectic a(a) phase diagrams of homologous series of liquid crystals obtained experimentally may be divided into at least 4 types: (a) bia-(4′-n-alkanote benzal)-1.4 phenylenediamines, (b) 4-n-alkyloxybenzoic acid-4′-n-alkyloxylphenyl ester, (c) 4-n-alkyloxybenzylidene-4′ amino-α-cyano-2 methylbutyl cinnamate, (d) 4-n-alkyloxy-4′-cyanobiphenyl. The authors propose theoretical explanations of the phase diagrams by use of a modified McMillan Hamiltonian. (8 refs.)

72106 Reentrant behavior and cyano substituted aryl p-alkoxycinnamates. N.H.Tinh (Centre de Recherche Paul Pascal, Domaine Univ., Talence, France).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.285-94 (1983).
Several new homologous series of cyano substituted aryl *p*-alkoxycinnamates have been synthesized. The reentrant behavior of these series is compared with those of the *p*-alkoxybenzoates series. The influence of the length of the conjugated system on the reentrant phenomenon is studied. (25 refs.)

72107 **Calorimetric study of the smectic-*A*-smectic-*C* phase transition in liquid crystals.** M.Meichle, C.W.Garland (Dept. of Chem., MIT, Cambridge, MA, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2624-31 (May 1983).
High-resolution AC calorimetric measurements have been made on azoxy-4,4′-di-undecyl-α-methylcinnamate (AMC-11), butyloxybenzylidene heptylaniline (4O.7), heptyloxybenzylidene hexylaniline (7O.6), and heptyloxybenzylidene butylaniline (7O.4). The heat capacity C_p exhibits a sharp, asymmetric peak near the second-order smectic-*A*-smectic-*C* transition. The C_p values increase in the smectic-*C* phase as the transition temperature T_c is approached and then decrease abruptly at T_c. These data are well described by a mean-field Landau model and are not consistent with the heliumlike critical behaviour expected from the de Gennes model. It is also shown that it is very difficult to distinguish between meanfield and *XY* critical behavior on the basis of data obtained only in the smectic-*C* phase. (18 refs.)

72108 **Heat-capacity study of phase transitions in the liquid-crystal racemic 4-(2′-methylbutyl)phenyl-4′-*n*-nonyloxybiphenyl-4-carboxylate (2M4P9OBC).** J.M.Viner, C.C.Huang (School of Phys. & Astron., Univ. of Minnesota, Minneapolis, MN, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2763-6 (May 1983).
The heat capacity of racemic 4-(2′-methylbutyl)phenyl-4′-*n*-nonyloxybiphenyl-4-carboxylate (2M4P9OBC) has been measured in the vicinity of the Sm*C*-Sm*I*, Sm*I*-Sm*G*, and Sm*G*-Sm*H* phase transitions. The nature of the Sm*C*-Sm*I* transition will be discussed in the context of known microscopic pictures of each phase. In contrast to the continuous Sm*A*-hexatic-*B* phase transition found in *n*-hexyl-4′-*n*-pentyloxybiphenyl-4-carboxylate, an asymmetric heat-capacity anomal is identified in the Sm*C*-Sm*I* transition of 2M4P9OBC. (16 refs.)

72109 **X-ray study of the smectic A-nematic phase transition in 4-n-pentylphenyl-4-(trans-4′-n-pentylcyclohexyl) benzoate.** A.Rajewska, B.Pura, J.Przedmojski (Inst. of Phys., Warsaw Tech. Univ., Warsaw, Poland), R.Dabrowski.
Phys. Status Solidi a (Germany), vol.76, no.1, p.127-30 (16 March 1983).
X-ray critical scattering from $C_{29}H_{40}O_2$ near the smectic A-nematic phase transition are investigated. The critical exponents $\gamma, \nu_\parallel$ and $\nu_\perp$ are extracted from the data. The ratio of the longitudinal to the transverse correlation lengths $\xi_\parallel/\xi_\perp$, increases gradually with decreasing reduced temperature $t=(T-T_c)/T_c$, for $4\times10^{-4}\leq t\leq10^{-3}$. (7 refs.)

Mesomorphic properties of some nitro substituted azomethines .... See Entry 71866

Pretransitional behavior of 8-12 CB .... See Entry 71870

The influence of an external electric field on the structure of chiral Sm C* liquid crystal .... See Entry 71871

Absorption edge of liquid crystal TBBA and the effect of an electric field on the spectra .... See Entry 71876

Dependences of the parameters of the liquid-crystal order on the molecular hyperpolarizability .... See Entry 71877

Temperature dependence and asymmetry of the hypersound velocity in cyanobiphenyl liquid crystals .... See Entry 72050

64.70P Glass transitions

72110 **Effect of DMF on the glass transition temperature of vinylidene chloride-acrylonitrile copolymers.** M.Mucha, M.Kryszewski, A.Stodolny (Tech. Univ., Lodz, Poland).
Plaste & Kautsch. (Germany), vol.30, no.3, p.144-9 (March 1983). In German.
The variation of the glass transition temperature T_G with respect to the thermal expansion coefficients α_L and α_G of different compositions of vinylidene chloride/acrylonitrile copolymers were examined as a function of dimethyl formamide content. Dilatometer measurements show that the T_G value does not follow the known equation for T_G depression of plastics. The solvent appears to have two roles: (1) to reduce segment rotation and sometimes translation by penetrating between the polymer chains; (2) to vary cohesion between polymer chains through strong intermolecular polymer/solvent exchange. (20 refs.) *A.E.W.*

72111 **Influence of free volume fraction, inter/intramolecular energy ratio, and chain segment density on the Gibbs-DiMarzio theory of the glass transition.** A.R.Greenberg, R.P.Kusy (Dental Res. Center, Univ. of North Carolina, Chapel Hill, NC, USA).
Polymer (GB), vol.24, no.5, p.513-18 (May 1983).
Based upon computer analysis, the Gibbs-DiMarzio (G-DM) theory (1958) is evaluated for the case of (a) constant V_0 and (b) constant r where V_0 is the fractional free volume at T_g and r is the ratio of the hole (E_0) to the flex (ϵ) energy. For each respective case, results are presented in a reduced variables format that indicate the extent to which r and V_0 vary at the transition temperature as a function of the reciprocal degree of polymerization (P^{-1}). To further account for chemical differences that exist among polymers, an index (n) is introduced that ultimately incorporates the effective number average of chain atom segments ($\bar{x}$) per P. Using these reduced variables plots, the effects of V_0, r and n are compared with the T_g data for four well-documented polymers. Although the theory adequately describes the PMMA, PS and PVC data, for PαMS the fit is doubtful. The analysis demonstrates that, in order to maintain V_0 within the range of 0.015-0.045, r must remain within approximately 1.0-1.1. Moreover, under conditions of either constant V_0 or r, other more flexible polymers require that $n\gtrsim10$. (49 refs.)

72112 **The thermodynamics of the glass transition.** M.Hillert (Div. of Phys. Metall., Royal Inst. Technol., Stockholm, Sweden).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.3-13
The kinetic theory of the glass transition is examined. Some modifications are suggested in order to overcome some shortcomings. As a result, a thermodynamic description of the glass transition is obtained. It is demonstrated that the glass transition represents the beginning of a very gradual process of melting in the amorphous state. (17 refs.)

New halide glasses—bromide glasses based on $ZnBr_2$. I. Vitreous zinc bromide .... See Entry 71895

Small volume change on melting as a new criterion for easy formation of metallic glasses .... See Entry 71899

Connection between the low temperature acoustic properties and the glass transition temperature of fluoride glasses .... See Entry 72058

Some aspects of the miscibility behavior of polyester/halogenated polymer blends .... See Entry 72125

Metallic glasses .... See Entry 73026

Silicon-free oxynitride glasses via nitridation of aluminate glassmelts .... See Entry 73058

64.75 SOLUBILITY, SEGREGATION, AND MIXING

72113 **Solid solution of TiO_2 in mullite.** C.Baudin, M.I.Osendi, J.S.Moya (Inst. de Ceramica y Vidrio, CSIC, Madrid, Spain).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.185-7 (May 1983).
The titania solid solubility limit in mullite has been determined by X-ray diffraction and by X-ray dispersive energy techniques. The close agreement between the results obtained by the two different techniques allows the authors to fix at 1600°C the solid solubility of TiO_2 in mullite at 2.9±0.2 wt.%. (9 refs.)

72114 **Some further factors affecting the solubility of silicate cements [for dentistry].** A.T.Kuhn, W.Lesan, D.Setchell (Bio-Materials Sci. Dept., Inst. of Dental Surgery, London, England).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.191-4 (May 1983).
The authors have explored a number of variables, and show the importance of these on the rate of the dissolution process. These include the total volume of water (eluent) used, the concentration of an ion (F^-) present in the cement and known to be released from it. In addition, the effect of sample geometry has been studied by extending the surface area:volume ratios reported by previous workers. (6 refs.)

72115 **On the temperature of phase dissolution in real crystals.** J.N.Jagodzinski, Y.V.Kornyushin (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.213-14 (May 1983).
The atomic concentration of impurity in the matrix may differ from that averaged over the sample, concentration, in real crystals containing grain boundaries, dislocations, stacking faults and other sinks of impurity atoms. When the impurity content is rather small, this difference is critical. In this case, depletion of impurity in the matrix leads to a decrease of the temperature of the dissolution of the phase. Formulae for the dissolution temperature in real crystals of such systems are obtained and a method of experimental evaluation of the parameters of sinks in interstitial alloys is proposed. (4 refs.)

72116 **The release of organic species from the glass-ionomer cements [for dentistry].** A.T.Kuhn (Bio-Materials Sci. Dept., Inst. of Dental Surgery, London, England), W.A.Lesan, H.A.Painter.
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.224-8 (May 1983).
Eluates of glass-ionomer cements were examined for total organic content and organic release during dissolution. Comparisons were made with studies on silicate cements. The levels of leach-out were found to be reassuringly low. (13 refs.)

72117 **Interaction of impurities with grain boundaries in austenite.** G.A.Filippov (Inst. of Metallography & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.528-32 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the tendency for segregation of phosphorus, antimony, and tin at the boundaries of the original austenite grains. The strongest tendency was observed for phosporus; antimony and tin were less likely to segregate. Estimates were obtained of the energy of the interaction of phosphorus, antimony, and tin atoms with austenite grain boundaries. It was found that alloying of iron with nickel should increase the energy of the interaction of these impurities with the grain boundaries. (10 refs.) *A.T.*

72118 **A mass spectrometric investigation of the iron-chromium-cobalt system.** B.B.Argent, M.Ellis (Dept. of Metall., Univ. of Sheffield, Sheffield, England), G.Effenberg.
High Temp.-High Pressures (GB), vol.14, no.4, p.409-16 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
Activity measurements have been made with a Knudsen-cell mass spectrometer on Co-Cr and Co-Cr-Fe alloys over the temperature range 1350-2000K. The excess free enthalpies of mixing for liquid and face-centred cubic ternary solutions are negative, but positive values are noted for body-centred cubic solutions. (8 refs.)

72119 **Precipitation as the phenomenon responsible for the electrically inactive arsenic in silicon.** D.Nobili, A.Carabelas, G.Celotti, S.Solmi (CNR, Istituto LAMEL, Bologna, Italy).
J. Electrochem. Soc. (USA), vol.130, no.4, p.922-8 (April 1983).
The physical nature of the electrically inactive arsenic in silicon was investigated by annealing experiments performed on specimens doped in a wide range of concentration, up to 4×10^{21} cm^{-3}, obtained by ion implantation and laser annealing. Thermal treatments of these alloys at temperatures of 800°, 900°, and 1000°C provided solid solubility values which correspond to the carrier density in equilibrium with excess dopant. Additional confirmation that the electrically inactive arsenic is a precipitated phase was obtained by the kinetics of the annealing process. The occurrence of precipitation in an amount which is consistent with that of the electrically inactive dopant was confirmed by small angle X-ray scattering which provided also details on the size and shape of the particles. The latter are in form of thin platelets and match the structure of the silicon lattice. These results clearly contradict the models developed to account for the difference between carrier and arsenic concentration which hypothesize the formation of a high equilibrium concentration of complex point defects making the excess dopant electrically inactive. (31 refs.)

72120 **Clustering and phase separation in a binary alloy on the FCC lattice.** S.McKenzie (Dept. of Chem., Royal Holloway Coll., Univ. of London, Egham Hill, England).
J. Phys. C (GB), vol.16, no.13, p.2517-28 (10 May 1983).
Monte Carlo simulation techniques are used to investigate clustering and phase separation in a binary alloy of equimolar composition (AB) on a face-centred cubic lattice with 6912 sites. The formation of spanning paths and connected clusters of B atoms is studied as a function of the reduced inverse temperature $x(=\Delta\epsilon/kT)$, where $\Delta\epsilon$ measures the difference in the interaction energy between unlike and like nearest-neighbour (NN) pairs of atoms. A further generalisation is introduced into the model in the form of a minimum-valence restriction, so only those B atoms surrounded by at least mNNB atoms are considered in the analysis. Values of m in the range 0 to 10 are treated. (36 refs.)

72121 A statistical mechanical model for chemical disorder in interacting systems: Application to phase separation in alkali silicates, alkaline earth silicates and alkaline earth aluminosilicates. R.J.Araujo (Res. & Dev. Labs., Corning Glass Works, Corning, NY, USA).
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.257-67 (May 1983).
The present model provides a formalism for studying the effects of chemical disorder in a system of interacting atoms in which the number of neighbors of each kind of atom need not be the same. When they are the same, this model reduces to the quasi-chemical approximation. It is applied to a model for phase separation in alkali silicates and alkaline earth silicates which involves a mixture of fourfold and sixfold coordinated species. The sixfold coordinated species represents a pseudo-atom comprised of two silicon atoms each bonded to non-bridging oxygen atoms which are strongly associated. A miscibility dome similar to that observed in sodium silicates and barium silicates is predicted. The suppression of phase separation by alumina is predicted. (5 refs.)

72122 Enthalpy of solution of ammonium iodide in water. R.Weintraub, A.Tamir, A.Apelblat (Dept. of Chem. Engng., Ben Gurion Univ. of the Negev, Beer Sheva, Israel).
J. Chem. Thermodyn. (GB), vol.15, no.5, p.403-7 (May 1983).
New molar enthalpies of solutions of NH_4I in water at 298.15K were measured in an LKB calorimeter. So as to prevent decomposition of ammonium iodide, hydroxylamine sulfate and sodium hydroxide were added in different quantities. The molar enthalpies of solution extrapolated to infinite dilution are: $(13877 \pm 37)\ J.mol^{-1}$ and $(13871 \pm 41)\ J.mol^{-1}$. In the absence of hydroxylamine sulfate and sodium hydroxide, values of $(13940 \pm 35)\ J.mol^{-1}$ (Alfa) and $(13983 \pm 12)\ J.mol^{-1}$ (Merck) were obtained. (8 refs.)

72123 Semiempirical theory of solid solubility in metallic alloys. J.M.Lopez, J.A.Alonso (Dept. de Fisica Teorica, Univ. de Valladolid, Valladolid, Spain).
Phys. Status Solidi a (Germany), vol.76, no.2, p.675-82 (16 April 1983).
A semiempirical theory of solid solubility in metallic alloys is presented. The theory is based on Miedema's semiempirical expression for the heat of solution. Since atomic size mismatch effects are not included in Miedema's theory, and since they are crucial in substitutional solid alloys, a term is added to account for those effects. This term is derived from elastic continuum theory. A simple approximation is used for the entropy of mixing. The theory is applied to continuous solid solutions and to almost insoluble systems. (21 refs.)

72124 Phase separation in epoxy resins containing polyethersulphone. C.B.Bucknall, I.K.Partridge (School of Industrial Sci., Cranfield Inst. of Technol., Cranfield, England).
Polymer (GB), vol.24, no.5, p.639-44 (May 1983).
Scanning electron microscopy and dynamic mechanical spectroscopy have been used to study phase separation of dissolved polyethersulphone (PES) from trifunctional and tetrafunctional epoxy resins during curing. No phase separation was observed at high concentrations of the tetrafunctional resin. Observations of nodules on fracture surfaces, and of multiple peaks in the dynamic mechanical spectra provided evidence for a separate, crosslinked, PES-rich phase in the remaining materials. Despite the variety of morphologies obtained in mixtures of PES with different hardeners and resins, modulus and fracture toughness showed little dependence upon composition. (13 refs.)

72125 Some aspects of the miscibility behavior of polyester/halogenated polymer blends. R.E.Prud'homme (Dept. de Chimie, Univ. Laval, Quebec City, Quebec, Canada).
Polym. Eng. & Sci. (USA), vol.22, no.17, p.1138-42 (mid-Dec. 1982). (Second Mini-Symposium on Polymer Blends, 'Polyblends '82', Montreal, Canada, 20 April 1982).
Glass transition temperature and depression in melting point methods are commonly used to determine the miscibility behavior of polymer/polymer blends, where at least one component of the mixture is semicrystalline. However, these methods often lead to ambiguous and even contradictory results, as is shown by several examples. A comparison of the miscibility behavior of poly(vinyl chloride), poly(vinyl bromide), and poly(vinyl fluoride) with linear and branched polyesters indicates that small changes in the structure of the halogenated polymer and/or of the polyester lead to major changes in miscibility, indicating the subtle nature of the miscibility phenomenon and emphasizing difficulties in its control. (17 refs.)

72126 Sulphur effect on the oxygen induced segregation phenomena on Ni-30%Cr alloy. P.Humbert, A.Mosser (Lab. de Cristallographie, Univ. Louis Pasteur, Strasbourg, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.708-13 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Segregation phenomena induced by oxygen on a (111) face of a nickel-chromium alloy (30%Cr) during oxidation and following vacuum annealing have been studied by Auger electron spectroscopy. Both with a clean and with a sulphur-covered surface, the results show a chromium enrichment provided the temperature allows sufficient mobility of surface atoms. Sulphur enhances this segregation. (12 refs.)

72127 Volumes of mixing of liquid alloys. K.Okajima, H.Sakao (Dept. of Metall., Nagoya Univ., Nagoya, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.223-35 (April 1983).
Statistical approach was made with a purpose of explaining the base curves drawn empirically in the cases of excess molar volumes of the liquid Bi-Ag and Bi-Cd alloys measured previously, taking into account number of the valence electrons per atom in the liquid alloys. Thus, the complicated anomalous behaviors in the excess molar volumes with composition were commonly interpreted for a number of the alloy systems. It was made clear that the excess molar volumes deviated from the base curves showed anomalous increase or decrease asymmetrically on both component rich sides, but such behaviors were closely related with the particular compositions in the phase diagrams such as the eutectic, solid solubility limit, intermetallic compound and so on. (62 refs.)

72128 Ostwald ripening in two phase mixtures with application to rapid solidification. P.W.Voorhees, M.E.Glicksman (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.33-47
Rapid solidification invariably results in fine-scale microstructures with concomitant fine-scale segregation. These microstructures, which are produced relatively far from equilibrium, have large specific surface energies and tend to coarsen rapidly. Experiments were carried out on highly supercooled bulk specimens of elemental P_4 in which the average temperature of rapidly solidified 2-phase mixtures was accurately monitored over time. A continuous rise in temperature toward the bulk melting point is always measured, independent of the volume fraction of solid produced at recalescence. New theoretical work shows that this temperature rise can be associated with the Ostwald ripening of the as-solidified solid-plus-liquid mixture. The theory permits calculation of coarsening rates after recalescence and the distribution of dendritic particle sizes as a function of time. Implications for establishing limiting dendritic particle sizes are discussed. (13 refs.)

Second Mini-Symposium on Polymer Blends, 'Polyblends '82' .... See Entry 69781

Thermodynamical interpretation of the structural and enthalpic properties of the crystallization of the Fe-B glasses .... See Entry 71892

Chemical short-range order and phase separation in Pr-Ga-Fe glasses .... See Entry 71896

Distribution of nitrogen atoms between interstices in the ferrite lattice at high temperatures .... See Entry 71957

Dislocation nucleation and precipitation of impurity in calcium-doped NaCl-KCl crystals .... See Entry 71966

On calculated energies of segregation, grain boundary energies and lattice energy functions .... See Entry 71976

Si implantation in GaAs .... See Entry 71994

Transmission electron microscopic observation of precipitates in Si^+ ion-implanted GaAs .... See Entry 71995

Irradiation induced precipitation in tungsten based, W-Re alloys .... See Entry 72018

Multiplicity of causes of grain-boundary fracture .... See Entry 72039

Thermodynamic evaluation of mixed working fluids .... See Entry 72138

High temperature internal oxidation behaviour of dilute Ni-Al alloys .... See Entry 72166

Surface segregation in Pt-Cu alloys .... See Entry 72201

Transient diffusion kinetics in media exhibiting axial variation of diffusion properties. I. Sorption kinetics .... See Entry 72229

Transient diffusion kinetics in media exhibiting axial variation of diffusion properties. II. Permeation kinetics .... See Entry 72230

AES and EELS study of hydrogen adsorption, oxygen adsorption and sulphur segregation on a clean titanium surface .... See Entry 72895

Investigation of phase stability in the system SiC-AlN .... See Entry 73043

Isotropy of spinodal decomposition in Fe-30% Cr .... See Entry 73063

Microsegregation and extended solid solutions after rapid solidification of aluminium alloys .... See Entry 73076

Formation and stability of extended solid solutions made by rapid quenching from the melt .... See Entry 73077

Considerations of solute-drag in relation to transformations in steels .... See Entry 73081

The precipitation of tungsten hemi-carbide (W_2C) in tungsten wafers .... See Entry 73087

The kinetics of σ-phase precipitation in AISI 310 and AISI 316 steels .... See Entry 73088

Segregation to interphase boundaries in liquid-phase sintered tungsten alloys .... See Entry 73089

High-resolution electron microscopy study of a Ti-1.6 at.% N alloy .... See Entry 73090

The sequence of phases in Al-Cu alloys .... See Entry 73091

Some aspects of micro-alloying .... See Entry 73092

Microsegregation of an aluminum and magnesium alloy at high solidification rates .... See Entry 73094

Modification of the spinodal hardening in a Cu-9 wt.% Ni-6 wt.% Sn alloy by 0.1 wt.% silicon or aluminium addition .... See Entry 73098

Effect of preceding heat treatments on the process of quench ageing in Fe-N alloys .... See Entry 73101

Effect of precipitates formed during pre-ageing on the process of quench ageing in Fe-N alloy .... See Entry 73102

Transmission electron microscopy of an annealed and nitrided Fe-600 wt.ppm Ti alloy .... See Entry 73116

Role of grain boundary segregation in diffusional creep .... See Entry 73144

Crack and cavity nucleation at interfaces during creep .... See Entry 73145

The effects of segregation on the kinetics of intergranular cavity growth under creep conditions .... See Entry 73146

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures .... See Entry 73147

High temperature embrittlement of Ni and Ni-Cr alloys by trace elements .... See Entry 73198

Some solid-state properties of blends of polyethylene terephthalate and polyamide-6,6 .... See Entry 73206

Sensitization of austenitic stainless steels. II. Commercial purity alloys .... See Entry 73264

64.80 OTHER PHASE PROPERTIES OF SYSTEMS

72129 Analysis of mercury cadmium telluride by energy dispersive analysis. D.C.Gillies (Univ. Space Res. Assoc., Marshall Space Flight Center, Huntsville, AL, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.689-97 (July 1982). [received: Nov. 1982]
An electron microprobe analysis technique using energy dispersive spectrometry has been developed for rapid quantitative analysis of mercury cadmium telluride at high spatial resolution. The results can demonstrate a difference of x in $Hg_{1-x}Cd_xTe$ of 0.002 between two locations as close as 5 μm, the accuracy in x being dependent on how well determined are the composition of the standards employed. Damage to the sample is limited by the low (10 keV) excitation potential and low current used. The method is applicable to bulk crystals and LEP grown material. (10 refs.)

72130 Ultrahigh-resolution electron microscopy of charge-density waves in $2H$-$TaSe_2$ below 100K. J.M.Gibson, C.H.Chen, M.L.McDonald (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1403-6 (2 May 1983).
Ultrahigh-resolution transmission-electron micrographs display $3a_0$ periodic distortions of the crystal lattice in $2H$-$TaSe_2$ associated with charge-density waves below 120K. Approximate structure-factor magnitudes and signs within single domains of the commensurate phase are determined. The data fit well only one of the models recently derived from ^{77}Se NMR. The charge-density-wave amplitude is 30% less in the orthorhombic direction for this

model. The center of symmetry within the orthorhombic unit cell is determined. Images from incommensurate phases are discussed. (12 refs.)

72131 Influence of solidification parameters on the microstructure of rapidly quenched Fe-Ni-B alloys. U.Koster (Abt. Chemietech., Univ. of Dortmund, Dortmund, Germany), U.Herold, D.Krause.
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.179-84
The microstructure of Fe-Ni-B alloys rapidly quenched by melt spinning has been investigated by means of light and electron microscopy. Depending on the surface velocity of the quenching wheel and the boron concentration, a large variety of microstructures has been observed: increased solubility of boron, microstructures with different metastable crystalline compounds or metallic glasses. Plotting the as-cast microstructures versus the quenching rate has been found to be very useful for arranging the large amount of results and/or for predicting particular microstructures. Due to an extremely large gradient in the microstructure across the ribbon thickness this method of forming particular microstructures seems to be only of limited advantage. Controlled crystallization reactions of metallic glasses result in different, but more homogeneous microstructures. (7 refs.)

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting ....See Entry 69790

Coherency strain fields: magnitude and symmetry ....See Entry 71846

Microstructures of glassy and metastable crystalline phases formed from Fe-C ternary alloys ....See Entry 71905

Nonstoichiometry of inorganic solids ....See Entry 71955

Microstructure of Sm_5Ni_{19} intermetallic compound observed by high-resolution electron microscope ....See Entry 71982

Undercooling behavior of liquid metals ....See Entry 72079

Growth kinetic limitations during rapid solidification ....See Entry 72088

Ostwald ripening in two phase mixtures with application to rapid solidification ....See Entry 72128

Nuclear magnetic resonance studies on sequence distributions in vinyl alcohol-vinyl acetate copolymers ....See Entry 72687

The influence of microstructure on the dielectric spectra of ferrites ....See Entry 72728

Control over the structure of hard metals and other heterophase materials produced by liquid-phase sintering. I. Liquid-phase migration and general principles of sintering of 'skeletonless' alloys ....See Entry 73020

Cooling rates and fine microstructures of RSR and argon atomized superalloy powders ....See Entry 73033

Electrical resistivity, magnetoresistance and microstructure of carbon-fiber/CVD-carbon composite ....See Entry 73056

Rapid solidification—mechanisms, morphology and microstructure ....See Entry 73079

Microsegregation of an aluminum and magnesium alloy at high solidification rates ....See Entry 73094

Comparison of the quench rates attained in gas atomized powders and melt-spun ribbons of Co and Ni base superalloys: influence on resulting microstructures ....See Entry 73118

Characteristics of microstructure during tensile deformation of superplastic Al-Zn eutectoid alloy ....See Entry 73143

65.00 THERMAL PROPERTIES OF CONDENSED MATTER

(see also 05.70 Thermodynamics, 63. Lattice dynamics; for thermal conduction in nonmetallic liquids, see 66.60; for thermal conduction in nonmetallic solids, see 66.70; for electronic thermal conduction, see 72.15, 72.20 and 74.30E; for thermodynamic properties of quantum fluids, see 67.40, 67.50, and 67.60; for thermal properties of solid helium, see 67.80)

65.20 HEAT CAPACITIES OF LIQUIDS

72132 Evaluation of the intermolecular specific heat of quasi-spherical molecular liquids from thermo-acoustic data. B.K.Sharma (Dept. of Phys., Regional Coll. of Education, Bhubaneswar, India).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.107-10 (18 April 1983).
A relationship between the microscopic Gruneisen parameter and the thermodynamic Gruneisen parameter has been examined and analysed for several quasi-spherical molecular liquids and their ratio is utilized to measure the intermolecular specific heat and specific heat ratio. Calculated data on the Gruneisen parameter, intermolecular specific heat ratio and intermolecular isobaric specific heat taken up by the molecular vibrations for these liquids are presented. It is seen that the intermolecular vibrations contribute from about 28 to 50% of the total isobaric specific heat in these liquids. (12 refs.)

Rigid backbone polymers: thermal behavior of polyhexylisocyanate mesomorphic solutions ....See Entry 71867

Calorimetric study of the smectic-*A*-smectic-*C* phase transition in liquid crystals ....See Entry 72107

Heat-capacity study of phase transitions in the liquid-crystal racemic 4-(2′-methylbutyl)phenyl-4′-*n*-nonyloxybiphenyl-4-carboxylate (2M4P9OBC) ....See Entry 72108

65.40 HEAT CAPACITIES OF SOLIDS

(for specific heat of superconductors, see 74.30E; for specific heat of magnetic systems, see 75.40)

72133 Thermophysical properties of the intermetallic Mn_3MN perovskites. I. Heat capacity of the manganese nitride Mn_4N. J.Garcia, J.Bartolome, D.Gonzalez (Dept. de Termologia, Univ. of Zaragoza, Zaragoza, Spain), R.Navarro, D.Fruchart.
J. Chem. Thermodyn. (GB), vol.15, no.5, p.465-73 (May 1983).
The heat capacity of Mn_4N has been determined in the range from 5 to 345K by adiabatic calorimetry and between 335 and 500K using DSC. No anomaly was found in the temperature range covered. The thermodynamic functions at 298.15K are $C_p/R=15.01$, $S°(T)/R=17.19$, $\{H°(T)-H°(0)\}/R=2712.8$K, and $\{G°(T)-H°(0)\}/RT=8.089$. From the analysis of the various contributions to the heat capacity, the values $\gamma=0.042$ $J.mol^{-1}.K^{-2}$ for the electronic coefficient, and $\Theta_D(0)=433$K for the Debye temperature at $T\rightarrow 0$, have been obtained. The determination of the lattice contribution for $T<350$K will allow one to use it as a common lattice base line to estimate the lattice contribution to C_p of other members of the series. (19 refs.)

72134 Specific heat of lead chalcogenides. S.N.Lykov, I.A.Chernik (Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1755-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3102-5 (Oct. 1982). [received: April 1983]
A comparative study of the lattice specific heat C_p of lead chalcogenides has been carried out at temperatures in the hydrogen-helium range. The behavior of $C_p(T)$ in this range of PbSe and PbS was investigated first. Under the traditional interpretation of the measurements in terms of the Debye theory the authors obtained the temperature dependence of $\theta_D(T)$, demonstrating the qualitative and quantitative agreement of the phonon spectra of these compounds. For the limiting magnitudes of $\theta_D(0)$ they have found the values 170, 200, and 210K for PbTe, PbSe, and PbS, respectively. They have also observed, and discuss briefly, a number of anomalies in the specific heat of these materials. (5 refs.)

72135 Thermodynamic properties of impurity band electrons. S.D.Baranovskii, A.A.Uzakov, A.L.Efros (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.422-9 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.756-67 (Aug. 1982). [received: May 1983]
The electronic specific heat $c_v(T)$ of a lightly doped compensated semiconductor is computed in a broad range of temperatures with the aid of the method of Monte Carlo computer simulation of the impurity band. The results of the simulation of the three-dimensional system confirm the existence in the function c_v/T of the low-temperature dip that was predicted earlier on the basis of a self-consistent equation for the density of dipole-excitation states. Somewhat unexpected is the discovery of a similar dip in the case of the two-dimensional system, for which the self-consistent-equation method does not reveal any low-energy anomalies in the density of states of the excitations determining the specific heat. New data pertaining to the properties of the ground state of the system in question are obtained incidentally. (9 refs.)

Fast two-level systems in vitreous silica ....See Entry 71897

Bandwidth narrowing in n-type many-valley semiconductors ....See Entry 72300

Connection between the heat capacity and the effective mass of the electrons in Fermi-liquid theory at finite temperatures ....See Entry 72336

Quantum correlations to conductivity and energy relaxation in InP and InSb ....See Entry 72398

Correlation of electrical resistivity and heat capacity of silicides of rare-earth metals with the composition R_5Si_4 ....See Entry 72402

Sintered boron—production and properties. II. Mechanical and thermophysical properties ....See Entry 73208

65.50 THERMODYNAMIC PROPERTIES AND ENTROPY

72136 Analytical evaluation of ternary thermodynamics from investigations by Knudsen-cell mass spectrometry. J.Tomiska (Inst. fur Phys. Chem., Univ. Wien, Wien, Austria).
High Temp.-High Pressures (GB), vol.14, no.4, p.417-22 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
The application of Knudsen-cell mass spectrometry to thermodynamic investigations on ternary systems is very limited. The experimental effort required is very large and evaluation of the measured data is very time-consuming. A considerable reduction both of the experimental work and of the time spent on evaluation can be expected by applying the suggested analytical evaluation technique. This is based on an adapted Redlich-Kister approximation of the excess thermodynamic functions which is suitable for computer calculations. The technique is then to adjust the expansion parameters by a best fit of all the experimental data for the entire composition range. Consequently investigations along special concentration lines with a constant ratio of the mole fractions of two components are no longer required and there is therefore a reduction in experimental effort. The suggested evaluation technique is described for applications to investigations by means of the ratio/Gibbs-Duhem method, but is also easily applicable to the evaluation of other mass spectrometric data. (22 refs.)

72137 Thermodynamics of the $U_xPu_{1-x}O_{2-z}$ system in the liquid range. J.-F.Babelot, M.Hoch, R.W.Ohse (Commission of the European Communities Joint Res. Centre, Karlsruhe Establ., European Inst. for Transuranium Elements, Karlsruhe, Germany).
High Temp.-High Pressures (GB), vol.14, no.4, p.431-9 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
To calculate the vapour pressures of the various gaseous species above $U_xPu_{1-x}O_{2-z}$, especially in the liquid range, a regular-solution model has been developed for the mixture UO_2-PuO_2-$PuO_{1.5}$, and the various free energies of formation have been evaluated. In the UO_2-PuO_2-$PuO_{1.5}$ triangle, the UO_2-PuO_2 system is ideal; in the UO_2-$PuO_{1.5}$ system the interaction parameter is 5.15 kJ mol^{-1}; and in the PuO_2-$PuO_{1.5}$ system the interaction parameter is 15.14 kJ mol^{-1}. The free energies of formation are summarized, and an example of calculation of the partial pressures is shown. (21 refs.)

72138 Thermodynamic evaluation of mixed working fluids. Y.Yoshida, Y.Mukai (Central Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.111-19 (Feb. 1983). In Japanese.
Mixed working fluids have recently attracted attention, especially in refrigeration cycle, Rankine cycle, and thermosyphon cycle, but there is little information on their thermodynamic properties. Consequently the authors have developed estimation programs by using a generalized equation of state, applying new methods in evaluating enthalpy and entropy of the vapor-liquid coexisting phase. They have also examined programs for mixtures of fluorinated hydrocarbons, and provided techniques which give more precise estimation. Finally, they have completed an automatic plotting system of characteristic diagrams such as the VLE diagram, pressure-enthalpy diagram, temperature-entropy diagram and enthalpy-composition diagram. (29 refs.)

Internal variables and the thermodynamics of macromolecule solutions ....See Entry 71607

Equilibrium properties of a 2-2 electrolyte model—Monte Carlo and integral equation results for the restricted primitive model ....See Entry 71857

Acoustic and thermodynamic properties of some liquids on hard sphere model with attractive interactions ......See Entry 72047

Thermodynamic properties of liquid thorium monocarbide up to the critical point ......See Entry 72076

High-temperature vaporization and thermodynamics of the titanium oxides. XVII. Approximate oxygen potentials in metal-rich solutions ..See Entry 72093

The thermodynamics of the glass transition ......See Entry 72112

A theoretical analysis of the phase-decompositions based upon the non-linear diffusion equation ......See Entry 73064

A thermodynamic analysis of the tin-tellurium system and calculation of the phase diagram ......See Entry 73070

The correlation of the thermodynamic properties of wustite by a gaussian based formalism ......See Entry 73073

Considerations of solute-drag in relation to transformations in steels ......See Entry 73081

Standard free energy of formation of iron iodide ......See Entry 73358

Osmotic and activity coefficients of some pyridine complexes with halogenoacetic acids in benzene at 25°C ......See Entry 73364

65.70 THERMAL EXPANSION AND THERMOMECHANICAL EFFECTS

(see also 64.30 Equations of state; for electronic thermal conduction, see 72.15 and 72.20; for thermal conductivity of superconductors, see 74.30E; for pyroelectric and electrocaloric effects, see 77.70)

72139 Effect of pressure on the measurement of thermal expansion of polymers. T.I.Ponomareva, Yu.M.Paramonov, V.I.Irzhak, B.A.Rozenberg.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.3, p.205-6 (1983). In Russian.
The value of the thermal expansion coefficient in viscoelastic polymers depends on measuring conditions, and chiefly on applied stress. Experimental results are therefore often not reproducible. Here the thermal expansions of epoxy polymers are reported as functions of applied pressure. It is shown that in the vitreous state the thermal expansion coefficient is dependent of stress, but that it increases linearly with applied stress for viscoelastic polymers. (3 refs.) *C.J.S.*

72140 Generation of thermal strains in GRP. I. Effect of water on the expansion behaviour of unidirectional glass fibre-reinforced laminates. F.R.Jones, M.Mulheron, J.E.Bailey (Dept. of Metall. & Materials Technol., Univ. of Surrey, Guildford, England).
J. Mater. Sci. (GB), vol.18, no.5, p.1522-32 (May 1983).
The temperature dependence of the linear expansion coefficients in the longitudinal (α_l) and transverse directions ($\alpha_{t(1)}$ and $\alpha_{t(2)}$) of unidirectional glass fibre laminates and their matrix resins (α_m) has been studied. The results for the dry, fully post-cured polyester, epoxy resins and laminates have been found to be consistent with the predictions of the Schapery equations. An anomalous moisture phenomenon, in the form of a peak in the $\alpha_m(T)/T$ and $\alpha_t(T)/T$ curves for the polyester resin and laminates has been observed. A difference between $\alpha_{t(1)}$ and $\alpha_{t(2)}$ has been observed for partially cured polyester laminates, which is also perturbated in the presence of water. Both these moisture effects, which are not found in the epoxy specimens, are considered to result from a two-phase polyester matrix and the latter to continued curing below the softening point of the resin. These results have a considerable consequence on the magnitude of the thermal strains which develop in polyester composites. (19 refs.)

72141 Generation of thermal strains in GRP. II. The origin of thermal strains in polyester cross-ply laminates. F.R.Jones, M.Mulheron, J.E.Bailey (Dept. of Metall. & Materials Technol., Univ. of Surrey, Guildford, England).
J. Mater. Sci. (GB), vol.18, no.5, p.1533-9 (May 1983).
For pt.I see ibid., vol.18, p.1522-32 (1983). The temperature dependence of the thermal strains in the longitudinal direction of the transverse ply $\epsilon_{tl}{}^{th}$, of 0°/90°/0° epoxy and polyester laminates, has been determined from the thermal variation of the deflection of an unbalanced beam. These results have been compared with those predicted from known values of the linear expansion coefficients α_t and α_l. There is good agreement between the experimental and calculated values of thermal strain for the epoxy composite. Good agreement for the polyester laminates can only be obtained when the values of α_t used are those for wet laminates. The large thermal strains previously reported for the polyester laminates can therefore be explained by small quantities of water in the matrix which are not readily removed during post-curing. (12 refs.)

72142 Study of the swelling of an Al-Ar-O alloy by an acoustic emission method. M.E.Gurevich, V.S.Zgura, L.N.Larikov (Inst. of Metal Phys., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.731-3 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.57-9 (Sept. 1982). [received: March 1983]
The material investigated was a metastable aluminum-argon-oxygen alloy containing fine alumina particles. A single physical (acoustic emission) method was employed for studying the swelling dynamics of this material. Stress waves set up by swelling processes were recorded by means of a piezoelectric pickup and apparatus including standard units for studying acoustic emission signals. Measurements were made under conditions of continuous heating at a rate of 10K/min. A characteristic spectrum of acoustic emission of the Al-Ar-O alloy during heating is shown. It reveals four clearly defined swelling stages, each being represented by a surge of acoustic signal intensity. (3 refs.)

Effect of DMF on the glass transition temperature of vinylidene chloride-acrylonitrile copolymers ......See Entry 72110

Some properties of fine-grained mixtures of $ZrSiO_4$-ZrO_2 ......See Entry 73048

Silicon-free oxynitride glasses via nitridation of aluminate glassmelts ......See Entry 73058

Characteristic martensitic transformation of the Fe-Pt disordered alloys around the γ-α phase boundary ......See Entry 73084

Sintered boron—production and properties. II. Mechanical and thermophysical properties ......See Entry 73208

65.90 OTHER TOPICS IN THERMAL PROPERTIES OF CONDENSED MATTER

72143 IR emission spectroscopy of molten salts and other liquids using thick samples as reference. J.Hvistendahl, E.Rytter, H.A.Oye (Inst. of Inorganic Chem., Norwegian Inst. of Technol., Univ. of Trondheim, Trondheim, Norway).
Appl. Spectrosc. (USA), vol.37, no.2, p.182-7 (March-April 1983).
The IR emittance of liquids relative to a blackbody is dependent on the reflectivity at the surface of the sample. This dependency leads to distortions in the bandshapes except when the absorption coefficient or the sample thickness is very low. The use of an opaque (i.e. very thick) samples as a reference eliminates the distortions in the bandshapes. A new emittance ϵ^*=(emission of a thin sample)/(emission of an opaque sample) has been introduced. A theoretical analysis as well as experimental work on chloroaluminate melts demonstrate that the emittance ϵ^* gives a better representation of the ideal sample property of interest, i.e. the internal transmittance of the sample, than does the usual emittance with a blackbody as a reference. (19 refs.)

72144 Integral emittance of niobium during high-temperature heating and oxidation. V.K.Mel'nikov, V.N.Kovalev.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.69-74 (1983). In Russian.
Results of an experimental investigation of chemical kinetics and integral normal emittance of chemically-reacting niobium plates during non-stationary heating by a high-temperature argon-oxygen flow are presented. (8 refs.)

66.00 TRANSPORT PROPERTIES OF CONDENSED MATTER (NONELECTRONIC)

66.10 DIFFUSION AND IONIC CONDUCTION IN LIQUIDS

72145 The determination of ionic transport numbers by use of radiotracers. P.J.Smith, T.L.Jones (Winnington Lab., ICL pcl, Winnington, Northwich, England).
J. Electrochem. Soc. (USA), vol.130, no.4, p.885-90 (April 1983).
Reports details of a recirculating transport cell for the determination of sodium ion transport numbers by radioactive tracer methods. The construction and operation of the transport cell are discussed and, in order to illustrate the scope of the transport cell, data concerning sodium ion transport in a 1200 equivalent weight Nafion membrane are presented. The ion transport data are interpreted in terms of membrane electrolyte sorption and membrane water content. (9 refs.)

72146 Radiometric absorption method for continuous observation of diffusion in molten metals. P.Kubicek, B.Vozniakova (CSAV, Ostrava, Czechoslovakia).
Jad. Energ. (Czechoslovakia), vol.29, no.4, p.136-41 (April 1983). In Czech.
The radiometric absorption method for continuous observation of diffusion in molten metals is analysed. On the basis of its theory experimental equipment was assembled and measurements of ^{110}Ag diffusion into molten Zn at a temperature near the boiling point of Zn was carried out. The values of the diffusion coefficient of ^{110}ag→Zn at the mean temperature 886.5°C ranged from $(7\text{-}10)\times10^{-5}$ cm^2/s. (7 refs.)

72147 Self and mutual diffusion measurements in dilute and semidilute polystyrene solutions. T.Cosgrove, J.M.Sutherland (School of Chem., Univ. of Bristol, Bristol, England).
Polymer (GB), vol.24, no.5, p.534-6 (May 1983).
Self-diffusion coefficients have been obtained for polystyrene (M_w=37000) solutions in toluene (D_8) and cyclohexane (D_{12}) by the pulsed field gradient NMR technique at 303K. Mutual diffusion coefficients have been obtained by photon correlation spectroscopy (PCS). In a poor solvent (cyclohexane) both techniques show a similar trend of a monotonic decrease in the diffusion coefficient with increasing concentration of polymer. However, in a good solvent (toluene) NMR shows a monotonic decrease in the diffusion coefficient whereas PCS shows an increase. The results are discussed in terms of self and mutual diffusion processes. (17 refs.)

Generalized treatment of self-diffusivity for the gaseous and liquid states of fluids ......See Entry 71677

A modified constriction model for the resistivity of a bubble curtain on a gas evolving electrode ......See Entry 71686

Diffusion and orientability of rigid-rod molecules ......See Entry 71868

Refractive index increment of polymers in ternary systems with special reference to diffusion measurements ......See Entry 72747

Quasi-elastic light scattering of Carnauba wax in the liquid phase: dynamics. I ......See Entry 72816

66.20 DIFFUSIVE MOMENTUM TRANSPORT

(inc. viscosity of liquids)

72148 The temperature dependence of coefficient of viscosity for $Cu_{60}Zr_{40}$ and $Ni_{64}Zr_{36}$ metallic glasses. E.Girt (Faculty of Sci., Univ. of Sarajevo, Sarajevo, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.1, p.29-35 (Jan.-March 1983).
The cold finger method was used for dilatometric measurements of $Cu_{60}Zr_{40}$ and $Ni_{64}Zr_{36}$ amorphous samples at elevated temperatures under applied tensile stress. The creep process was identified from the experimental data by separation of the free volume annealing process. It was found out that this process occurs at lower temperatures for the $Ni_{64}Zr_{36}$ system and that it follows a linear time dependence. The coefficient of viscosity was evaluated from the data for creep for both systems, their functional dependence on temperature was given and activation energies for the systems were evaluated. The obtained temperature dependence of the coefficient of viscosity was of the form $\eta=\eta_0\exp(\Delta E/kT)$. The evaluated activation energies for $Cu_{60}Zr_{40}$ and $Ni_{64}Zr_{36}$ amorphous systems were 178.8 kJ/mole and 41.2 kJ/mole, respectively. (6 refs.)

Experimental measurements of the effect of viscosity on drag for liquid drops ......See Entry 71613

66.30 DIFFUSION IN SOLIDS

A theoretical analysis of the phase-decompositions based upon the non-linear diffusion equation .... See Entry 73064

The effects of segregation on the kinetics of intergranular cavity growth under creep conditions .... See Entry 73146

66.30D Theory of diffusion and ionic conduction in solids

72149 Theory of diffusion in a polycrystalline materials. G.Zaeschmar (Energy Conversion Branch, Naval Ocean Systems Center, San Diego, CA, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2281-6 (May 1983).
A new approach to the general theory of diffusion in polycrystalline materials has been taken. By means of introduction of a third empirical parameter, the filling time of a grain, the mass transfer coefficient between the boundary of two media can be determined in only a typical grain dimension and the bulk diffusion constant are known. A subsequent expression for the diffusion in a finite length grain boundary permits the determination of the grain boundary diffusion constant. A stack of circular cylinders is used as a model. It permits calculation of the concentration functions for large penetration depth as well as bottom to top filling of an individual cylinder.

72150 Quantum diffusion of atoms in a crystal. Localization and phonon-stimulated delocalization. Yu.Kagan, L.A.Maksimov (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.242-4 (2 May 1983).
Localization phenomena in the subsystem of interacting particles which diffuse by tunneling in a crystal is considered. The temperature dependence of the diffusion coefficient is found for the regime of phonon-stimulated delocalization. The quantum diffusion in ^{3}He-^{4}He solid state solution is analysed especially, and comparison is made with the results of Micheev et al. (1982) who first observed this phenomenon. (10 refs.)

Diffusion of toluene in polystyrene and improved free volume theory .... See Entry 72171

Transient diffusion kinetics in media exhibiting axial variation of diffusion properties. I. Sorption kinetics .... See Entry 72229

Transient diffusion kinetics in media exhibiting axial variation of diffusion properties. II. Permeation kinetics .... See Entry 72230

66.30F Self-diffusion in metals, semimetals, and alloys

A comparative analysis of the ordering kinetic laws for the derivation of the vacancy mobility parameters in concentrated alloys .... See Entry 71931

Role of grain boundary segregation in diffusional creep .... See Entry 73144

66.30H Self-diffusion and ionic conduction in nonmetals

72151 Self-interstitial and vacancy contributions to silicon self-diffusion determined from the diffusion of gold in silicon. F.Morehead (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), N.A.Stolwijk, W.Meyberg, U.Gosele.
Appl. Phys. Lett. (USA), vol.42, no.8, p.690-2 (15 April 1983).
The authors present an analysis of gold diffusion profiles in silicon taking into account that both self-interstitials and vacancies are present at thermal equilibrium. They find that at 1000°C the contribution of self-interstitials to silicon self-diffusion is about equal to that of vacancies. (19 refs.)

72152 Sodium deposition in fast ion conductors. Guo Zhu-kun, Li Xiang-ting (Shanghai Inst. of Ceramics, Acad. Sinica, Shanghai, China).
Acta Phys. Sin. (China), vol.32, no.3, p.406-10 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Sodium deposition in beta-, beta″-Al_2O_3 and Nasicon ($Na_3Zr_2Si_2PO_{12}$) was studied by using EPMA. Based on the mechanism of ion transportation and electrolytic deposition with a diminished carrier concentration, a kinetic equation for sodium deposition has been derived, which can fit well the time dependence of the sodium counts during electron bombardment. Since an abundant source of mobile Na^+ ions exists in the large single crystal, the rise of the curve of beta-Al_2O_3 extends over a long period of time. However, the crystallites in the Nasicon polycrystal are small ($<10\ \mu m$) the Na^+ ion therefore may be provided insufficiently at the electron bombarded point for a prolonged deposition due to the hindrance of the grain boundaries in the ion transport process. The deposition attains its saturation limit rapidly. (10 refs.)

72153 Interface between solid electrode and solid electrolyte—a study of the $Li/LiL(Al_2O_3)$ solid-electrolyte system. T.R.Jow, C.Liang (Electrochem Industries Inc., Clarence, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.737-40 (April 1983).
The interface contact between a solid electrolyte and a solid electrolyte during discharge was examined, using the $Li/LiI(Al_2O_3)/PbI_2$, Pb solid-state galvanic cell. Upon discharge, Li at the interface is oxidized to Li^+ which migrates through the electrolyte to the cathode. The departing Li^+ ions leave vacant sites at the Li anode surface. When the discharge rate exceeds the diffusion rate of Li to fill the vacant sites, the interface contact may be damaged resulting in a separation between the Li anode and the $LiI(Al_2O_3)$ electrolyte. Based on the discharge time required for such a separation to occur, the Li diffusivity in the Li anode was determined to be $(5.6\pm0.9)\times10^{-11}\ cm^2/sec$ at ambient temperature (24°±2°C). In addition, from the results of anode polarization experiments, the exchange current density of $Li/LiI(Al_2O_3)$ was determined to be $145\pm25\ \mu A/cm^2$ at 24°±2°C. (8 refs.)

72154 Optical and electrical properties of yttria stabilized zirconia (YSZ) crystals. R.C.Buchanan, S.Pope (Dept. of Ceramic Engng., Univ. of Illinois at Urbana-Champaign, Urbana, IL, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.962-6 (April 1983).
Optical transmission spectra ($\lambda=0.3$-$50\ \mu m$) and DC conductivity (25°-1000°C) data were obtained on yttria stabilized zirconia (YSZ) single crystals commercially grown by the skull-melting process. The crystals were doped with up to 2.0 w/o rare earth (Ce, Nd, Er, Pr) and transition (Mn, Fe, Cr, Ni) metal ions, and a few were annealed. Dopant effects were most pronounced in the visible region, but were evident throughout much of the spectral range. Annealing and dopant ions Ce and Er showed significant absorption effects attributed to the Ce^+ ion. Electrical conductivity was only marginally affected by doping. (12 refs.)

72155 Ionic conductivity of sodium β'' alumina in the very far infrared. W.Hayes, G.F.Hopper (Clarendon Lab., Oxford Univ., Oxford, England).
J. Phys. C (GB), vol.16, no.13, p.2529-36 (10 May 1983).
The authors have carried out measurements of the ionic conductivity of sodium β'' alumina in the region 2-200 cm^{-1}. The temperature dependence of the measurements was studied in the range 2-600K. The results show many configurations of sodium ions in the conduction slab of sodium β'' alumina and are used to draw comparisons between the conduction mechanisms of sodium β alumina and sodium β'' alumina. (14 refs.)

72156 Electrical behaviour of doped-yttria stabilized zirconia ceramic materials. C.Pascual, J.R.Jurado, P.Duran (Inst. de Ceramica y Vidrio, CSIC, Madrid, Spain).
J. Mater. Sci. (GB), vol.18, no.5, p.1315-22 (May 1983).
Single-phase sintered ceramic materials $(ZrO_2)_{1-x}\{(Y_2O_3)_y(RE_2O_3)_{1-y}\}_x$ (RE=Nd, Ce, Dy, Er) were synthesized and electrical conductivity and transport number measurements were made as a function of temperature between 500 and 1200°C. The activation energies of conduction were determined, and it was found that the charge carriers in these solid solutions are oxygen ions. The fabricated electrolyte discs were used in cells of the type P_{O2}, Pt/zirconia solid solution/P'_{O2}, platinum where P_{O2}=air (0.21 atm) and P'_{O2}=1 atm or argon-O_2 mixtures. Below 700°C, the EMF deviated from the theoretical values for completely ionic conduction; good agreement was observed above this temperature. (17 refs.)

72157 Oxygen self-diffusionin MgO single crystals. Y.Oishi, K.Ando, H.Kurokawa, Y.Hiro (Dept. of Nuclear Engng., Kyushu Univ., Hakozaki, Fukuoka, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C60-2 (April 1983).
Oxygen self-diffusion coefficients in two MgO single crystals were determined by an isotope exchange technique at 1300° to 1750°C using chemically polished samples. There is a sharp break in the temperature dependence at 1500°c. The high-temperature regime is represented by $D=6.76\ \exp[-536(kJ/mol)/RT]\ cm^2/s$, indicating an impurity-insensitive diffusion mechanism. Extrinsic diffusion in the low-temperature regime was interpreted to be structure-sensitive. (10 refs.)

72158 Effect of gamma radiation on the direct-current resistivity of GeO_2. R.H.Magruder,III, D.L.Kinser, R.A.Weeks (Coll. of Engng., Vanderbilt Univ., Nashville, TN, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C62-3 (April 1983).
Results of DC resistivity measurements on high-purity GeO_2 glasses before and after radiation with ^{60}Co are reported. For these glasses, the DC resistivity is increased by irradiation in a stable and reproducible fashion. This effect is attributed to the interaction of radiation-induced defects with the sodium-ion charge carriers. (13 refs.)

72159 Influence of disorder on the diffusion of alkali ions in SiO_2-and GeO_2-glasses. R.Kirchheim (Inst. fur Werkstoffwissenschaften, Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.243-55 (May 1983).
The frequency factor and activation energy for the diffusion of Na and K in SiO_2-glasses are strongly dependent on the concentration of Na_2O or K_2O respectively. A similar behavior was found for hydrogen diffusion in amorphous metals. In the last case the results are in agreement with theoretical calculations, if a Gaussian distribution of activation energies is assumed which arises from a similar distribution of the potential energy of hydrogen being in equilibrium sites. The equations derived were used in this study to describe the concentration dependence of Na and K diffusion in SiO_2 glasses, because these impurities are dissolved in randomly distributed interstices of different volume as well. The theory yields the two experimental facts that diffusion below the glass transformation temperature is governed by a single activation energy and that concentration profiles of the tracer atoms can be described by a constant diffusion coefficient. A comparison with low temperature results for Na diffusion shows they agree with theoretical predictions and yield the following parameters: most probable value of the activation energy=59.4 kJ/mol, corresponding frequency factor=$2\times10^{-3}\ cm^2/s$ and half width of the Gaussian distribution=25 kJ/mol. The model also predicts a minimum in plots of the chemical diffusivity versus concentration which is in agreement with experimental findings for sodium diffusion in GeO_2. (23 refs.)

72160 Influence of the electric double layer on glass leaching. T.M.Sullivan (Nuclear Engng. Program, Univ. of Illinois, Urbana, IL, USA), A.J.Machiels.
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.269-82 (May 1983).
When a glass comes into contact with water, an electric double layer forms at the glass-water interface. An analytical model that calculates the electric field and the resulting velocity of univalent alkali ions migrating in the glass matrix is developed. The ion migration velocity is calculated for an 85% SiO_2-15% Na_2O glass and for more complex glasses. The calculations indicate that the process of ion migration leads to normalized leach rates which are small compared to glass network dissolution rates. (18 refs.)

72161 Tracer diffusion and electrical conductivity in sodium-cesium silicate glasses. H.Jain, N.L.Peterson, H.L.Downing.
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.283-300 (May 1983).
The tracer diffusion coefficients of ^{22}Na and ^{137}Cs, and the electrical conductivity have been measured in the $(Na, Cs)_2O{:}3SiO_2$ glasses as a function of temperature and Cs/Na ratio. Complex impedance analysis was used for the conductivity measurements. The Haven ratio at 396.5°C increases from 0.3-0.4 in single-alkali glasses to 0.8 for the mixed-alkali compositions. The results are explained in terms of a single-jump mechanism; interactions between alkali ions and non-bridging oxygen ions, and between different alkali ions, produced the observed correlation effects. (26 refs.)

72162 Ionic conductivity of amorphous $mNaF$-nMF_3 thin films ($M=Al$, Cr). J.-M.Dance, T.Oi (Central Res. Lab., Hitachi Ltd., Tokyo, Japan).
Mater. Res. Bull. (USA), vol.18, no.3, p.263-8 (March 1983).
Evaporated 0.5 to 0.7 μm thick thin films of $mNaF$-$nAlF_3$ and $mNaF$-$nCrF_3$ were prepared in a 1 mPa vacuum on glass substrates kept at room temperature. Chemical analysis and AC conductivity measurement revealed that in each case studied, a high ionic conductivity plateau existed for the composition range $0.1<n/(m+n)<0.4$. The maximum conductivities at room temperature were $\sigma=1\times10^{-6}$ S/m for NaF-AlF_3 and $\sigma=2\times10^{-5}$ S/m for NaF-CrF_3. Those high conductivities were discussed in terms of arrangement of MF_6 octahedra. (9 refs.)

Electrical conductivity and phase transition studies on pure and doped (Cd^{2+}, Gd^{3+}) $KNaSO_4$ and $K_3Na(SO_4)_2$. II .... See Entry 72099

NMR study of solid perfluorocyclobutane .... See Entry 72693

Standard free energy of formation of iron iodide .... See Entry 73358

66.30J Diffusion, migration, and displacement of impurities

72163 Extremely rapid outdiffusion on *n*-type impurities in InP. A.K.Chin, B.V.Camlibel, V.Dutt, V.Swaminathan, W.A.Bonner (Bell Labs., Murray Hill, NJ, USA), A.A.Ballman.
Appl. Phys. Lett. (USA), vol.42, no.10, p.901-3 (15 May 1983).
During sealed ampoule annealing at 550°C, an unexpected, deep diffusion front were determined to be $1\text{-}5\times10^{-8}$ cm^{-8} cm^2 s^{-}1 which is approximately two orders of magnitude greater than that of the rapidly diffusing Zn impurity. By measuring the changes in the CL intensity and the photoluminescence linewidth to determine the changes in carrier concentration, the diffusion fronts were shown to be caused by the outdiffusion of the dopants. Although outdiffusion of Cr and Fe, affecting an ~1 μm surface region during thermal annealing at 550°C for 30 min, has previously been reported observationm of rapid outdiffusionof *n*-type impurities that can affect InP crystals to a substantial depth (~200 μm) for similar annealing conditions. (15 refs.)

72164 Electrical properties of Te diffused silicon. Yong-Hyun Paek, Chul-Sung Kim.
Trans. Korean Inst. Electr. Eng., vol.31, no.12, p.198-205 (1982). In Korean.
The diffusion coefficient of tellurium in silicon is measured. The concentration distribution of tellurium is determined by the method of the sheet resistance and the junction depth through the oxide layer, and by the measurement of the sheet resistance and sheet Hall coefficient as a function of temperature. The temperature dependence of the diffusion coefficient of Te with the energy level of 0.14 ± 0.01 eV below the conduction band edge in silicon can be expressed: $D=1.1\times10^{-2}\exp[-(2.6\pm0.2)\ \mathrm{eV}/kT]\ \mathrm{cm^2/sec}$. (28 refs.)

72165 Influence of material properties on the retention of fission products by silicon carbide coatings. R.Forthmann, E.Gyarmati, J.Linke, E.Wallura (Inst. fur Reaktorwerkstoffe, Kernforschungsanlage Julich GmbH, Julich, Germany).
High Temp.-High Pressures (GB), vol.14, no.4, p.477-85 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
Annealing of cold-irradiated coated fuel particles gave diffusion coefficients of $^{110}\mathrm{Ag}^{m}$ in silicon carbide coatings as a function of the SiC deposition temperature and the carrier-gas composition. The silver diffusion coefficient was found to increase from 8.0×10^{-17} m^2 s^{-1} to 2.0×10^{-16} m^2 s^{-1} with deposition temperatures ranging from 1300 to 1550°C, if SiC was deposited in pure hydrogen. In SiC coatings deposited in argon-hydrogen mixture the silver diffusion coefficients were found to decrease from 9.9×10^{-17} m^2 s^{-1} to 7.3×10^{-17} m^2 s^{-1} over the same range of deposition temperatures. This transport behaviour is not directly correlated with microstructural defects, density, grain size, and optical parameters of the coatings. However, radially oriented regions with different responses to etching seem to play a decisive role in the diffusion of silver in silicon carbide coatings. (5 refs.)

72166 High temperature internal oxidation behaviour of dilute Ni-Al alloys. H.Hindam (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), D.P.Whittle.
J. Mater. Sci. (GB), vol.18, no.5, p.1389-401 (May 1983).
The internal oxidation of dilute Ni-Al alloys, either pure or containing small additions of tantalum or hafnium, was investigated at 1200°C in air. The advance of the precipitation zone followed la parabolic relationship at a slightly decreasing rate with increasing aluminium content. The precipitate shape, size and spacing depended upon the aluminium concentration and more significantly on the active element additions. The morphology varied from polyhedral crystallites and epitaxial platelets in the Ni-0.5 wt% Al alloy, to well-defined cylindrical rods extending across the precipitation zone approximately normal to the reaction interface, in the alloys of higher aluminium content. An also continuous and similarly oriented plate-like morphology was observed in the active element-containing alloys. X-ray microanalysis indicated that the continuous precipitates consisted of $NiAl_2O_4$ and Al_2O_3. No correlation was found between either the growth rate or oxygen permeability and the distribution of the precipitates. It was, therefore, concluded that the interfacial boundaries were ineffective in accelerating oxygen transport at this elevated temperature. (23 refs.)

72167 Centrifuge studies of the sedimentation of nickel in lead. S.K.Sen, H.B.Huntington (Dept. of Phys., Rensselaer Polytech. Inst., Troy, NY, USA), R.S.Sokolowski.
Scr. Metall. (USA), vol.17, no.4, p.569-72 (April 1983).
The technique of sedimentation under a centrifugal force field is used to study the equilibrium configuration of Ni solute impurities in lead. The mechanism of diffusion is discussed. (13 refs.)

72168 Determination of diffusion coefficients of tritium in the α-phases of titanium and Hafnium. W.Kunz, H.Munzel, U.Helfrich, H.Horneff (Inst. fur Anorganische Chem. & Kernchem., Techn. Hoschschule Darmstadt, Darmstadt, Germany).
Z. Metallkd. (Germany), vol.74, no.5, p.289-93 (May 1983). In German.
Studies on the diffusion of tritium in the IV-b-metals titanium and hafnium were performed. The results are: Ti: $D=2.1\times10^{-3}$ cm^2/s$\times\exp(-46.6$ kJ/mol$/RT)$ $133°\mathrm{C}<T<415°\mathrm{C}$ Hf:$D=6.0\times10^{-4}$ cm^2/s$\times\exp(-41.9$ kJ/mol$/RT)$ $200°\mathrm{C}<T<360°\mathrm{C}$. To implant tritium in the specimens a nuclear-reaction-method was used, allowing a tritium-implantation being independent of the chemical properties of the metal surface. The results are discussed and compared with published data on the ^{1}H-diffusion. (28 refs.)

Suppressing Al outdiffusion in implantation amorphized and recrystallized silicon on sapphire films ....See Entry 71985

Gettering of oxygen in Si wafers damaged by ion implantation and mechanical abrasion ....See Entry 71998

Problem of behavior of oxygen in Si ....See Entry 72001

Self-interstitial and vacancy contributions to silicon self-diffusion determined from the diffusion of gold in silicon ....See Entry 72151

Establishment of a relationship between the diffusion parameters and microscopic characteristics of point defects by the computer simulation method ....See Entry 72169

Anomalous sorption kinetics curves and Fick diffusion ....See Entry 72213

Diffusion-controlled reaction of water with glass ....See Entry 73329

66.30L Diffusion, migration, and displacement of other defects

72169 Establishment of a relationship between the diffusion parameters and microscopic characteristics of point defects by the computer simulation method. B.F.Kostromin, Yu.M.Plishkin, I.E.Podchinenov, I.Sh.Trakhtenberg (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.450-4 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A method for calculating the diffusion parameters using a dynamic computer model was proposed earlier by the present authors [Fiz. Met. Metalloved. 53, 109 (1982)]. An analysis of the relationship between the activation energy of heterodiffusion and microscopic characteristics of the interaction of point defects is given in the present paper. This makes it possible to select critically the potential of the interaction of the matrix atoms with one another and with impurity atoms and, moreover, it suggests a way of obtaining a microscopic description of diffusion on the basis of the experimental data. Moreover, the microscopic diffusion parameters can be calculated if the energy of the interaction of impurity atoms with vacancies is known. (14 refs.) *A.T.*

72170 Grain-boundary diffusion in metals. N.L.Peterson (Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).
Int. Met. Rev. (GB), vol.28, no.2, p.65-91 (1983).
The available models for grain-boundary diffusion are reviewed together with the relevant mathematical techniques for extracting the grain-boundary diffusivity from the various types of experimental data. The more useful experimental techniques are described, followed by a presentation of results that shed light on the models and mechanisms of grain-boundary diffusion. A 'pipe' mechanism of diffusion based on the well established dislocation model seems most appropriate for small-angle boundaries. Open channels which have atomic configurations somewhat like dislocation cores, probably play a major role in high-angle grain-boundary diffusion. Dissociated dislocations and stacking faults are not efficient paths for grain-boundary diffusion. The diffusion and computer-modelling experiments are consistent with a vacancy mechanism of diffusion by a rather well localized vacancy. The atomic migration is a three-dimensional process with jumps away from, and back towards, the dislocations as well as jumps along the dislocation core. (130 refs.)

Dislocation motion in cellular structures ....See Entry 71964

66.30N Chemical interdiffusion

72171 Diffusion of toluene in polystyrene and improved free volume theory. A.I.Maklakov, T.A.Serebrennikova.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.3, p.157-60 (1983). In Russian.
A universal free volume model is proposed for diffusion in polymers, which is valid for self-diffusion and inter-diffusion of macromolecules and small molecules. The improved model is based on the premise that the volume of a body is determined by the sum of its volume at 0K, its continuous free volume as caused by anharmonic molecular vibrations, and the free volume of holes. The model is used to calculate the temperature dependence of the diffusion coefficient for toluene in polystyrene. The calculated values agree closely with literature, experimental data in the range 320-350K. At lower temperature, however, the calculated values are significantly lower. (8 refs.) *C.J.S.*

The texture in diffusion-grown layers of trialuminides $MeAl_2$(Me=Ti, V, Ta, Nb, Zr, Hf) and VNi_3 ....See Entry 73111

Formation of the contact zone between a detonation-deposited coating and a basis material ....See Entry 73278

66.30Q Electromigration

72172 Experimental verification of the space-charge model for electrokinetics in charged microporous membranes. G.B.Westermann-Clark, J.L.Anderson (Dept. of Chem. Engng., Carnegie-Mellon Univ., Pittsburg, PA, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.839-47 (April 1983).
A space-charge model for electrolyte transport in charged capillary pores was examined experimentally with aqueous solutions of alkali chlorides and $MgCl_2$ in track-etched mica membranes. The model combines the Gouy-Chapman view of the double layer with the Nernst-Planck and Navier-Stokes transport equations. The pores of experimental membranes were uniform capillaries with a well-characterized cross section. The pore sizes ranged from an order of magnitude smaller to an order of magnitude larger than the Debye screening lengths of solutions. Three independent quantities were measured: streaming potential, for which an applied pressure across the membrane is the driving force for transport; pore conductivity, for which an applied electrical potential is the driving force; and concentration potential, for which an electrolyte concentration difference is the driving force. Data follow the trends of model predictions but indicate that chloride ions affect the pore wall charge. For monovalent cations, the pore wall charge deduced from pore conductivity measurements yielded theoretical predictions for the streaming potential and for the concentration potential that agree quite well with the data. Such agreement was not obtained with Mg^{2+}, probably because these divalent cations adsorbed onto the negative pore wall. In the absence of strong interaction between the charged pore wall and free ions in solution, the model is quantitatively accurate for pores larger than 30Å in radius and for aqueous electrolyte concentrations of 0.1M or lower. (19 refs.)

66.60 THERMAL CONDUCTION IN NONMETALLIC LIQUIDS

(for thermal conduction in liquid metals, see 72.15C)

72173 An equation for thermal conductivity of heavy water. J.Yata, T.Minamiyama (Kyoto Inst. of Technol., Kyoto, Japan).
Mem. Fac. Ind. Arts Kyoto Tech. Univ. Sci. & Technol. (Japan), vol.31, p.14-30 (Dec. 1982). [received: May 1983]
An equation for the thermal conductivity of heavy water (D_2O) is formulated in the temperature range up to 600°C and in the pressure range up to 3000 bar, based on the reliable experimental data available at present. Comparisons between the calculated values by the equation and the experimental data are given both in the liquid and vapor states. The degree of uncertainty of the equation is estimated to be 2~3% in the liquid state, 2~5% in the vapor state and of the order of 10% in the critical region, in the pressure range up to 1000 bar. In the pressure range from 1000 to 3000 bar, the degree of uncertainty is estimated to be 3~5% below the critical temperature and 5~10% above the critical temperature. The values of the thermal conductivity of heavy and ordinary water are compared by using the present equation for

heavy water and the previous one for ordinary water. The thermal conductivity of heavy water is shown to be smaller in the high density region and larger in the low density region than that of ordinary water. (18 refs.)

Prediction of transport properties. II. Thermal conductivity of pure fluids and mixtures .... See Entry 71681

66.70 NONELECTRONIC THERMAL CONDUCTION AND HEAT-PULSE PROPAGATION IN NONMETALLIC SOLIDS

(for thermal conduction in solid metals, see 72.15C and 72.15E; for statistical mechanics of lattice vibrations, see 63.70)

72174 Low temperature heat transfer studies on exfoliated vermiculite. C.R.Maiti (Cryogenic Engng. Centre, IIT, Kharagpur, India).
Indian J. Cryog., vol.7, no.4, p.168-72 (1982).
A radial heat flow type cylindrical calorimeter guarded at both ends has been fabricated for measuring apparent mean thermal conductivity of powder insulation. Measurements have been made on a number of particle sizes of exfoliated vermiculite at different vacuum levels over the temperature range of 300 to 77K. The results indicate that exfoliated vermiculite may be profitably used in low cost cryogenic insulation system. (4 refs.)

72175 Lattice thermal conductivity of II-VI compounds. R.D.Bijalwan (Phys. Dept., Garhwal Univ. Campus, Tehri, India), P.N.Ram, M.D.Tiwari.
J. Phys. C (GB), vol.16, no.13, p.2537-45 (10 May 1983).
The lattice thermal conductivity of four II-VI compounds, ZnS, ZnSe, ZnTe and CdTe, has been analysed on the basis of the Callaway formalism in the temperature range 2-300K taking separate contributions of longitudinal and transverse phonons. In the analysis the phonon scattering from boundary, point defects, and three-phonon processes has been considered. In the three-phonon processes the relaxation times having different temperature dependence in different temperature ranges have been used in the calculation. It is observed that the contribution of transverse phonons to the thermal conductivity is more than that of longitudinal phonons at all temperatures. Good agreement with the experimental results has been obtained. (19 refs.)

72176 Thermal conductivity of HgSe. S.M.Wasim, B.Fernandez, R.Aldana (Dept. de Fisica, Univ. de Los Andes, Merida, Venezuela).
Phys. Status Solidi a (Germany), vol.76, no.2, p.743-6 (16 April 1983).
The thermal conductivity of HgSe is measured at low temperatures. The pronounced depression in the magnitude of the thermal conductivity above 4K and other anomalous behaviour observed by other workers at higher temperatures are explained by taking into account the additional scattering of phonons by extended defects or clusters in Callaway's formalism. (12 refs.)

72177 Thermal conductivity of corundum, high-alumina, magnesia, zirconium, and chromate refractories in the 400-1800°C range. D.M.Shakhtin, V.I.Pechenezhskii, A.G.Karaulov, N.M.Kvasman, V.P.Kravchenko, I.I.Kabakova, V.A.Ustichenko, G.E.Kalita, G.N.Shcherbenko, L.M.Yakobchuk (Sci.-Res. Inst. for Refractories, Ukrainian SSR).
Refractories (USA), vol.23, no.5-6, p.223-7 (May-June 1982). Translation of: *Ogneupory (USSR)*, vol.23, no.5, p.16-20 (May 1982). [received: March 1983]
The temperature relationship of the thermal conductivity of corundum, mullite-corundum, magnesia, zirconium, and chromate refractory parts in the range of average temperatures of 400-1800°C was determined. Data are presented on their porosity, density, and chemical composition. (11 refs.)

The relation between the heat current and the phonon drift velocity .... See Entry 69827

Determination of the temperature field in a granular layer ..... See Entry 71335

Fast two-level systems in vitreous silica .... See Entry 71897

A thermodynamic development of generalized Fourier and Ohm conduction laws for anisotropic materials .... See Entry 72365

Field-property bounds for porous sintered ceramics .... See Entry 72386

Magnetic susceptibility of neutron and electron irradiated quartz versus the 'glassy' thermal conductivity .... See Entry 72575

Densification, thermal diffusion and Na vapor resistance of Y_2O_3 ceramics .... See Entry 73038

Effect of the type of binding material on the properties of refractory glass-fiber heat-insulation products .... See Entry 73155

Sintered boron—production and properties. II. Mechanical and thermophysical properties .... See Entry 73208

67.00 QUANTUM FLUIDS AND SOLIDS; LIQUID AND SOLID HELIUM

(see also 05.30 Quantum statistical mechanics)

67.50 FERMI FLUIDS; LIQUID HELIUM-3

72178 Resonant pulse propagation of sound in superfluid ^{3}He-*B*. O.Avenel (Service de Phys. du Solide et de Resonance Magnetique, CENS, Gif-sur-Yvette, France), M.Rouff, E.Varoquaux, G.A.Williams.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1591-4 (16 May 1983).
Superfluid ^{3}He-*B* offers a unique example of level crossing, that of the zero-sound mode and the internal 'real squashing' mode of the gap parameter. A full treatment of this classic problem is given which compares well with observations at 1.2 bars and 45 MHz. The characteristic beat pattern seen on-resonance is identified as a '0π-area' pulse, first discussed by Crisp (1970). The present findings for the signal velocity agree with Brillouin's well-known predictions. (13 refs.)

67.80 SOLID HELIUM AND RELATED QUANTUM CRYSTALS

72179 Wetting of FCC ^{4}He grain boundaries by fluid ^{4}He. J.P.Franck, K.E.Kornelsen, J.R.Manuel (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1463-5 (9 May 1983).
The observation of polygonated thin films of FCC ^{4}He in contact with the fluid is described. Partial melting of the polygonated structure allows the observation of the dihedral angle of fluid helium at a grain boundary. The fluid is shown to wet the grain boundaries almost completely. (17 refs.)

Quantum diffusion of atoms in a crystal. Localization and phonon-stimulated delocalization .... See Entry 72150

67.90 OTHER TOPICS IN QUANTUM FLUIDS AND SOLIDS (E.G. NEUTRON-STAR MATTER)

72180 On the possibility of attaining the Bose-condensation region in spin-polarized atomic hydrogen at ultra-low temperatures. Yu.Kagan, G.V.Shlyapnikov (Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.309-12 (9 May 1983).
It is shown that the adsorption of atomic hydrogen on the He^4 surface is predominantly accompanied by excitation of the surface wave. At ultra-low temperatures a strong decrease in the adsorption rate with temperature is found to result in a surface density of adsorbed atoms essentially lower than its equilibrium value. Therefore the channels of recombination of atomic hydrogen on the surface prove to be suppressed and it becomes possible to make compatible the Bose-condensation and the long lifetime of the spin-polarized atomic hydrogen gas. (17 refs.)

68.00 SURFACES AND INTERFACES; THIN FILMS AND WHISKERS

(for impact phenomena, see 79.; for physics of crystal growth, see 61.50C; for corrosion, oxidation, and surface treatments, see 81.60)

ECOSS-5. Proceedings of the Fifth European Conference on Surface Science .... See Entry 69782

68.10 FLUID SURFACES AND INTERFACES WITH FLUIDS

(inc. surface tension, capillarity, wetting and related phenomena)

72181 Systematics of metal-insulator interfacial energies: a new rule for wetting and strong catalyst-support interactions. A.M.Stoneham (Theoretical Phys. Div., AERE, Harwell, England).
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.249-59 (March 1983).
This work concerns three questions: How can one decide whether a particular liquid metal will wet a given oxide substrate? What does analysis of experimental data tell one about the nature of the metal-substrate interactions? Is there correlation with strong metal-support interactions in catalysis? Comparison of the trends predicted by the continuum results of Barrera and Duke (1976) with those observed shows that the dispersion contribution to metal-oxide interfacial energies cannot be the only important term. From the observed trends for non-reactive metal-oxide systems one deduces: (i) Wetting should be favoured by a low metal plasma frequency (i.e. low electron density). (ii) Wetting should be favoured by a small insulator bandgap. (iii) The insulator refractive index is especially useful as a classifier. It appears to be a rule that only for substrates with $n^2 \gtrsim 4.5$-5 does one find wetting by most non-reactive metals. The same rule is found for strong metal-support interaction, which should therefore correlate with wetting. (iv) Trace impurity effects are very pronounced whenever the impurity effects have potential consequences in many applied problems, including substrate effects in support catalysts, liquid phase sintering and liquid metal embrittlement. (21 refs.)

72182 On the calculation of solid-liquid interfacial tension in metallic systems from contact angle data. N.Eustathopoulos (Lab. de Thermodynamique et Phys.-Chimie Metall., ENSEEG, Saint Martin d'Heres, France), A.Passerone.
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.107-200 (May 1983).
Two main techniques are usually employed to determine solid-liquid interfacial tensions, σ_{SL}, in multicomponent metallic systems: it is calculated from contact angle measurements and from dihedral angle determinations. The first technique is faster and easier to use, but usually yields results which do not agree with those derived from the latter. This problem is discussed by a critical analysis of two sets of data referring to the same systems, namely solid zinc in contact with bismuth, indium, lead and tin melts. (19 refs.)

72183 The pressure tensor at the planar surface of a liquid. J.P.R.B.Walton, D.J.Tildesley, J.S.Rowlinson, J.R.Henderson (Phys. Chem. Lab., Univ. of Oxford, Oxford, England).
Mol. Phys. (GB), vol.48, no.6, p.1357-68 (20 April 1983).
The planar surface of a liquid of molecules with truncated Lennard-Jones potentials has been simulated at two temperatures. The normal component of the pressure tensor, $p_N(z)$, is shown to be a constant, independent of the height z. There are many possible definitions of the transverse component, $p_T(z)$; two of these are computed and are shown to differ by small but significant amounts. All definitions of $p_T(z)$ give the same value of the surface tension, but they lead to different values for the apparent height of the surface of tension, that is the height at which the tension is supposed to act. The difference is about 0.3-0.5 d, where d is the molecular collision diameter, for the two choices of $p_T(z)$ considered here. (18 refs.)

72184 Critical wetting in three dimensions. E.Brezin, B.I.Halperin (Phys. Dept., Harvard Univ., Cambridge, MA, USA), S.Leibler.
Phys. Rev. Lett. (USA), vol.50, no.18, p.1387-90 (2 May 1983).
A critical wetting (or interface delocalization) transition occurs when the interface between two fluid phases becomes infinitesimally bound to an attracting wall. It is shown that the critical exponents at this transition depend continuously on the parameter $\omega \equiv k_B T_w / (4\pi \xi_b^2 \sigma)$, where σ is the surface tension of the free interface, ξ_b is the bulk correlation length in the attracted fluid phase, and T_w is the transition temperature. (12 refs.)

72185 How corundum refractories are wetted by molten steel. A.E.Zhukovskaya, A.A.Kortel', E.A.Sherman, E.A.Prokof'eva, T.P.Korableva (All-Union Inst. of Refractories, USSR).
Refractories (USA), vol.23, no.9-10, p.504-7 (Sept.-Oct. 1982). Translation of: *Ogneupory (USSR)*, vol.23, no.9, p.50-3 (Sept. 1982). [received: May 1983]
Corundum refractories, modified with additions of Mg, Cr, and Zr oxides and silicon-containing substances designed for making the tiles of gate valves, were studied for the wettability by steel 45 at 1550°C. It was established that the incorporation of oxides of Zr, Cr; mixtures of Cr, Mg and Zr oxides; and also silicon-containing additives, increases the wetting angle of corundum refractories. The low wettability of these refractories by steel determines to a signif-

icant degree the high metal resistance in service of the gate-valve tiles. (8 refs.)

72186 Fluid droplet movement on a solid surface in a temperature gradient field. A.S.Dzyuba.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.549-53 (April 1983). In Russian.
The behaviour of fluid droplets on a solid surface is analyzed in temperature gradient. It is found that the droplets move on the surface in the direction of low temperature. A linear relationship is obtained for the droplet velocity vs. size. Coalescence in an ensemble of moving droplets of different sizes is observed under collision conditions. The coalescence is governed by the droplet velocity-size dependence. Size and temperature gradient limitations are found for the movement of droplets. (13 refs.)

Multilayer adsorption: a unified picture ....See Entry 72252
On models of interactive dynamical processes at surfaces ....See Entry 73366
Exchange of H_2S between air and water ....See Entry 73840

68.15 LIQUID THIN FILMS

72187 Measurement of liquid film profiles by moire topography. H.S.Kheshgi, L.E.Scriven (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).
Chem. Eng. Sci. (GB), vol.38, no.4, p.525-34 (1983).
Area-wide surface topography is continuously monitored with the moire technique, i.e. measurement of patterns formed by superposition of the warped image of a line grating on a similar reference grating. A simple method for reconstructing liquid film profiles from moire fringe patterns is developed. The method is tested with a known specimen, a convex lens. Leveling of an uneven liquid film by gravity and capillary force is followed and film profiles are measured at intervals of time. Waves flowing down an inclined plate and disturbances in a liquid curtain are viewed, as are small disturbances caused by the impingement of tiny surface-active particles. Possible application to control of coating operations is pointed out. (21 refs.)

72188 Laser-induced thermohydrodynamic effects in thin liquid membranes. G.Da Costa, F.Bentolila, E.Ruiz (Dept. de Fisica, Univ. Simon Bolivar, Caracas, Venezuela).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.313-15 (9 May 1983).
Thermocapillary effects are produced in liquid membranes suspended from rigid contours by heating with a 1 mW, focused laser beam. This induces pits with diameter 0.1 mm and lifetime 1 h after termination of heating. Self-modulation of the reflected and transmitted laser beams is reported. (9 refs.)

68.20 SOLID SURFACE STRUCTURE

72189 The effect of ion beams on the composition of $Cu_2O(111)$ surfaces. J.Herion, G.Scharl, M.Tapiero (Inst. fur Grenzflachenforschung und Vakumphys., KFA, Julich, Germany).
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.233-48 (March 1983).
$Cu_2O(111)$ surfaces were studied under conditions typically used in Auger depth profiling, i.e., under electron and ion bombardment. Compositional changes were measured with AES as a function of energy and mass of the ions. By increasing the ion energy from 0.5 to 4 keV and the atomic weight of the bombarding gas from 20 to 131, an increase of the oxygen-to-copper ratio by about 1% and 2.5%, respectively, was obtained. The Auger line shapes were not markedly influenced by a change of the ion energy. The oxygen-to-copper ratio increased by several percent during ion bombardment of a sample which was prepared by cleaving in situ. Heating to at least 150°C leads to a decrease of the oxygen enrichment as well as of the concentration of implanted Ar. No electron beam effects could be detected in these experiments. (24 refs.)

72190 The mechanism of the surface stabilization of CrO_2 magnetic powders. F.Garbassi, E.M.Ceresa (Novara Res. Center, Istituto Guido Donegani Spa, Novara, Italy), G.Basile, G.C.Boero.
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.330-50 (March 1983).
Previously (see Meter. Res. Bull, vol.17, p.1197, 1982). A new process for the stabilization of CrO_2 powders against degradation of magnetic properties has been proposed, based on a thermal treatment in the temperature range of 573-663K in an inert gas atmosphere. In this work, the authors have studied the modifications induced by the stabilization process on the CrO_2 acicular particles in order to clarify the mechanism by which the stabilization takes place. It was found that the bulk properties of CrO_2 are not noticeably affected, suggesting that only some surface layers are involved, and that the formation of massive reduced phases does not take place. Thermal analysis and XPS data showed how the surface is modified and which transformations are responsible for the stabilization. These transformations are related to and affect the different species of chromium and oxygen ions. The main reactions involved are the dehydration of β-CrOOH, the disproportionation of Cr^{4+} surface ions and the decrease of the surface concentration of the reactive OH^- groups. On the basis of this study, the authors suggest that modifications of the ion population of the superficial layers are sufficient for obtaining a good stability of the CrO_2 particles. (33 refs.)

72191 Surface compositions of copper-silicon alloys. T.C.Frank, J.L.Falconer (Dept. of Chem. Engng., Univ. of Colorado, Boulder, CO, USA).
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.359-74 (March 1983).
Auger spectroscopy of copper-silicon alloys showed that silicon is enriched at the surface of both an ordered compound, Cu_3Si, and a solid-solution alloy (5 at.% Si). The surface compositions are estimated using elemental standards. Silicon segregation is predicted by thermodynamic theories based on surface tensions of pure components and by the empirical Burton and Machlin rule. The Si(92 eV) Auger peak splits into two peaks upon alloying, making identification of alloyed silicon possible. Surface silicon is in an alloyed form for both Cu_3Si and $Cu_{0.95}Si_{0.05}$. Above 670K, additional silicon segregates to the surface of Cu_3Si and both alloyed and elemental silicon are present. Alloying copper with silicon results is weakened silicon bonds and clean Cu_3Si oxidizes much more rapidly in air than does elemental silicon. This weakened bonding may be one reason that copper catalyzes the reaction between methyl chloride and silicon to form methylchlorosilanes. (41 refs.)

72192 Study of thermal equilibrium in the neighbourhood of an imperfect contact surface between two solid bodies. H.Lanchon, B.Makaya, J.Saint Jean Paulin (Lab. d'Energetique et de Mecanique Theorique et Appliquee, CNRS, Nancy, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.8, p.597-600 (28 Feb. 1983). In French.
Using homogenization techniques, the authors study the influence of the roughness distribution at the interface between two solid media, on the thermal (or electrical) transfer between these two bodies. They obtain in particular the thermal contact resistance. (2 refs.)

72193 Oxygen and sulphur influence upon segregation at a nickel-chromium alloy surface. P.Humbert, A.Mosser (Lab. de Cristallographie, ERA, Strasbourg, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.8, p.601-4 (28 Feb. 1983). In French.
Segregation phenomena induced by oxygen on a (111) face of a nickel-chromium alloy (30% Cr) during oxidation and following vacuum annealing have been studied by Auger Spectroscopy. Both with a clean and a sulphur-covered surface, the results show a chromium enrichment provided the temperature allows sufficient mobility of surface atoms. Sulphur enhances this segregation. (7 refs.)

72194 Thermal rearrangement of surface of spherical nickel single crystal. N.A.Gorbatyi, S.Pulatova (Lenin Tashkent State Univ., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.74-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1295-9 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The equilibrium form of a crystal surface is taken to be the form of the crystal that is in thermodynamic equilibrium with its own vapor; in this case the free surface energy (FSE) is minimal for the given crystal volume. The surface configuration that satisfies the condition of minimum FSE is a Wulff polyhedron, that reflects the anisotropy of the specific surface energy (SSE). The authors examine rearrangement of the surface of spherical nickel single crystal in the process of high-temperature heating in an atmosphere consisting of the crystal's own vapor. (10 refs.)

72195 Microgeometry of contact surfaces through anisotropy assessment. N.Idrus (Royal Melbourne Inst. of Technol., Melbourne, Victoria, Australia).
IEEE Trans. Components, Hybrids & Manuf. Technol. (USA), vol.CHMT-6, no.1, p.60-5 (March 1983). (28th Annual Holm Conference on Electrical Contacts, Chicago, IL, USA, 13-15 Sept. 1982).
In order to predict accurately the electrical and thermal characteristics of contacting surfaces, a surface and thus three-dimensional (rather than a profile-based) specificiation of the contacting microgeometries is required. A method is described by which a three-dimensional assessment of the surface microgeometry is made using a minimum number of radial traverses of the surface. Hitherto, many parallel traverses had to be recorded for the same purpose. A computer simulation shows that the proposed method is highly promising. (9 refs.)

72196 Mean inner potentials of aluminium and copper. M.A.Ochando, A.Sanchez, C.R.Serna (Dept. de Fisica del Estado Solido, Univ. Complutense, Madrid, Spain).
J. Phys. C (GB), vol.16, no.13, p.L401-3 (10 May 1983).
Reflection high-energy electron diffraction patterns were taken from electropolished (100), (110) and (111) surfaces of aluminium and copper. From the displacements of the spots compared with the Bragg position the mean inner potentials were obtained, being 13.2 V for aluminium and 19.1 V for copper. (20 refs.)

72197 Scanning tunneling microscopy. G.Binnig, H.Rohrer (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.236-44 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Scanning tunneling microscopy, a novel technique based on vacuum tunneling, yields surface topographies in real space and work function profiles on an atomic sale. Surfaces are shown for Au(110), Si(111) and GaAs(111). (9 refs.)

72198 Multilayer relaxation in metallic surfaces as demonstrated by LEED analysis. H.L.Davis, J.R.Noonan (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.245-52 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Theoretical motivations are reviewed for investigation of multilayer relaxation in relatively simple metallic surfaces. Results from LEED analysis are presented which serve to demonstrate that multilayer relaxation measurably exists in Cu(100) and Cu(110) surfaces. The results from two independent LEED analyses for Cu(110) are shown to be in much better agreement with each other than the LEED results are with multilayer relaxation results obtained by high energy ion scattering. Multilayer relaxation results for other metallic surfaces also are reviewed briefly, and all available results are discussed in relationship to those obtained by a theoretical, model-type, inquiry of Landman et el. (1980). (15 refs.)

72199 He diffraction studies of Pt(110) (1×2). A.M.Lahee, W.Allison, R.F.Willis (Dept. of Phys., Univ. of Cambridge, Cambridge, England), K.H.Rieder.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.654-60 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Results are presented on the diffraction of ^{4}He atoms from the 1×2 reconstructed surface of Pt(110). The diffraction pattern observed indicates that the surface can be considered to have a one-dimensional corrugation. From the position of the rainbow maximum the corrugation amplitude is estimated to be $\sim$1.5 Å. Structural models for the surface are used to derive corrugation functions from the superposition of atomic charge densities. The results of hard wall scattering calculations from these large corrugations are compared with the experimental data. The results confirm that the large corrugation amplitude could arise from a displaced or missing row model. However, limitations in the present analytical theory prevent any definite distinction to be made concerning the detailed nature of the atomic displacements. These limitations are discussed in the light of the present results and previously published data. (11 refs.)

72200 Study of the Ag(110) surface by He diffraction. A.Luntz, L.Mattera, M.Rocca, S.Terreni, F.Trommasini, U.Valbusa (Istituto di Sci. Fisiche, Univ. di Genova, Genova, Italy).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.695-701 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The scattering of He beams from the Ag(110) surface has been studied for two beam energies and several angles of incidence. The analysis of the experimental data shows that the softness of the interaction potential must be carefully considered. A soft corrugated wall potential model which allows fast and accurate calculations is presented. The force parameter and the surface corrugation, strongly dependent on the incident energy, are derived as best fit parameters and do favourably compare with the values obtained by close-coupling calculations. The peak-to-peak corrugation is found to be significantly larger than for Ni(110) and Cu(110) surfaces. (11 refs.)

72201 Surface segregation in Pt-Cu alloys. A.D.van Langeveld, V.Ponec (Gorleans Lab., Rijksuniv. Leiden, Leiden, Netherlands).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.702-7 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Platinum-copper alloys, prepared by standard metallurgical techniques, cleaned and annealed in ultra high vacuum, were analyzed by Auger electron spectroscopy. The surface segregation of Cu was found to be only moderate. In the calculations of the surface composition from the Auger spectra Gallon's (1969) model was used, whereby corrections were made for differences in the backscattering coefficients and the different matrix densities of both metals. (17 refs.)

72202 Study of organic surfaces with UPS and metastable deexcitation spectroscopy. C.Reynaud, C.Juret, C.Boizau (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.733-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Studies a thin polyacrylonitrile film by metastable deexcitation spectroscopy, associated to UPS. Since it is purely superficial and a non-desctructive spectroscopy, MDS appears to be very well suited to the study of organic surfaces. The PAN sample is grafted on an Fe support by electropolymerization, a process which guarantees well-characterized and reproducible samples. The PAN reticulation produced by heat-treatment at $T=200°C$ appears clearly on the MDS spectra. The layer conductivity is better after the reticulation. The acrylonitrile molecular orbital energies seem to be weakly modified by the polymerization. (12 refs.)

72203 The atomic geometry of GaAs(110) revisited. C.B.Duke, S.L.Richardson, A.Paton (Xerox Webster Res. Center, Webster, NY, USA), A.Kahn.
Surf. Sci. (Netherlands), vol.127, no.2, p.L135-43 (April 1983).
Improvements in surface structure determination methodologies based on the analysis of experimental low-energy electron diffraction intensities are utilized to perform an R-factor structure determination for GaAs(110). In addition to the commonly-accepted structure (a top-layer bond-length-conserving rotation of the As outward and the Ga inward characterized by $\omega_1=27°$, relaxation of the top layer toward the bulk by 0.05 Å, and a relaxation of the second-layer Ga outward and As inward by 0.06 Å), a new structure is found which consists of a top-layer bond-length-conserving rotation of $\omega_1=7°$, relaxation of the top layer away from the bulk by 0.05 Å, and a converse second-layer relaxation of the Ga and As by 0.03 Å. This new structure may be distinguished from the accepted one and refinements thereof by examining the integrated intensities of the diffracted beams. When these are considered, a refinement of the accepted structure still provides the best description of measured low-energy electron diffraction intensity data, and is manifestly compatible with other recent analyses of photoemission and isochromat data. (15 refs.)

72204 A helium diffraction study of the reconstructed Au(100) surface. K.H.Rieder, T.Engel, R.H.Swendsen (IBM Zurich Res. Lab., Ruschlikon, Switzerland), M.Manninen.
Surf. Sci. (Netherlands), vol.127, no.2, p.223-42 (April 1983).
The reconstructed Au(100) surface has been investigated using He-diffraction techniques. The topmost layer is found to have a dominant (1×5) periodicity, whereby the corrugation appears one-dimensional in the direction of the longer unit cell. The complex LEED patterns observed for this surface must be due to secondary structural features such as minor atomic displacements in the topmost or lower layers. Several reconstruction models were considered and surface electron density calculations were performed to enable a comparison with the corrugation functions deduced from the He-diffraction data. (39 refs.)

72205 LEED intensity analysis of the (1×5) reconstruction of Ir(100). E.Lang, K.Muller, K.Heinz (Inst. fur Angewandte Phys., Lehrstuhl fur Festkorperphys., Univ. Erlangen, Erlangen, Germany), M.A.Van Hove, R.J.Koestner, G.A.Somorjai.
Surf. Sci. (Netherlands), vol.127, no.2, p.347-65 (April 1983).
A new LEED structural analysis is carried out for the (1×5) reconstruction of Ir(100). It is based on a recent set of experimental I-V curves obtained with a computer-controlled video camera. Special attention is paid to reproducibility and reliability, and an R-factor analysis is now included. The previously preferred structure (a buckled top layer that is quasi-hexagonally closed-packed and involves bridge sites) is confirmed with minor positional adjustments comparable to the uncertainty of the method. The other structural models that have been examined can clearly be rejected. (23 refs.)

Differential reflectometry and its application to the study of alloys, ordering, corrosion, and surface properties .... See Entry 70108

Fine-structure analysis of spin-polarized low-energy electron diffraction from W(001) .... See Entry 71840

Dynamical effects of the surface potential barrier in very low energy electron diffraction .... See Entry 71841

Sulphur effect on the oxygen induced segregation phenomena on Ni-30%Cr alloy .... See Entry 72126

Adsorption of oxygen and cesium by lanthanum hexaboride ....See Entry 72214

Plasmon excitation in Al-Mg surfaces .... See Entry 72467

Binding energy of electrons of surface atoms of oxidized 3d transition metals, obtained by the method of appearance-potential spectroscopy .See Entry 72889

Laser-induced surface reconstruction of semiconductors and metals .... See Entry 72894

Wavevector-resolved electron-energy-loss spectroscopy on the dangling-bond states of Si(111)-(2×1) .... See Entry 72905

Helium diffraction as a probe of surface structure .... See Entry 72912

SIMS depth profiling of Cr-Ni multilayer targets .... See Entry 72932

Study of morphology and composition of Pt-black catalysts. III. XPS study of Pt-black .... See Entry 72938

Angle-resolved photoemission studies of GaAs(100) surfaces grown by molecular-beam epitaxy .... See Entry 72955

XPS investigation of stainless steel surfaces heated in aqueous media .... See Entry 72963

Morphology of ductile metals eroded by a jet of spherical particles impinging at normal incidence .... See Entry 73228

The chemical composition of the T15K6 alloy subjected to diamond-electric polishing with applied vibration .... See Entry 73235

Surface melting of a medium carbon steel by laser treatment . See Entry 73272

In situ analysis of passive and transpassive films on nickel by modulated UV-visible reflection spectroscopy .... See Entry 73282

Studies of structure and dynamics in heterogeneous reactions .... See Entry 73367

68.25 MECHANICAL AND ACOUSTICAL PROPERTIES OF SOLID SURFACES AND INTERFACES

(for tribology, see 62.20P and 81.40P)

72206 Propagation of transversal surface acoustic waves (SAW) under heavy periodic electrodes in Y-cut quartz. E.Danicki.
Pr. Inst. Tele- & Radiotech. (Poland), no.92, p.5-19 (1983). In Polish.
Presents a propagation theory of transversal surface acoustic waves in piezoelectric substrate with deposited heavy metal electrodes on its surface. It was assumed that the mechanical properties of the electrodes should not be neglected. The analysis of the dispersion interrelations for waves near the synchronism with the electrodes has shown considerable effect of the electrodes mass on the shape and the mutual position of the stop bands for electrodes electrically closed and electrically short circuited. These considerations are based on the approximated effective surface impedance connecting the amplitudes of harmonic waves of electric fields and mechanical fields observed on the surface of piezoelectric substrate. Parameters of this approximation for Y-cut quartz substrate are given. The presented considerations are directly applicable to the theory of skimming acoustic wave devices. (21 refs.)

An ultrasonic bridge for the study of viscoelastic properties of thin interface films .... See Entry 71321

Brillouin scattering in thin deposited polymer films .... See Entry 72820

68.30 DYNAMICS OF SOLID SURFACES AND INTERFACE VIBRATIONS

72207 Multiphonon surface processes. Sun Hur-bin, Tsai Chien-hua (Inst. of Solid State Phys., Nanjing Univ., Nanjing, China).
Commun. Theor. Phys. (China), vol.1, no.1, p.19-25 (1982).
In catalysis and other surface phenomena, besides affording static influences, such as modifications in energy spectra and wave functions of atoms and molecules in chemisorbed states in contrast with those in free states, the substrate may also show its existence by participating in the dynamics. The present article intends to call attention to a class of multiphonon processes. The mechanism is explained through the discussion of a few examples. (3 refs.)

72208 Vibrations in superlattices; application to GaAs-AlAs systems. J.Sapriel (CNET, Bagneux, France), B.Djafari-Rouhani, L.Dobrzynski.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.197-201 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Bulk and surface vibrations in GaAs-AlAs superlattices are studied. The dispersion curves of propagating waves along the direction perpendicular to the layers are investigated for several values of the ratio of the layers thicknesses and comparisons are made between the results of the elasticity theory and those of a microscopic model of two alternating diatomic sublattices of GaAs and AlAs. For a number of monolayers larger than 5 and for the first branches of the dispersion curves, the two models give the same results. The conditions of existence of acoustic shear waves localized at the free surface of the superlattice are investigated theoretically and numerically with the help of the elastic model. (5 refs.)

72209 The spectroscopy of surface vibrations in ionic crystals by inelastic scattering of atoms. G.Benedek (Istituto di Fisica, Univ. di Milano, Milano, Italy).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.624-40 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The recent progress in the production of highly monochromatic atomic beams is paving the way for a full determination of the surface vibrational structure. Account is given of the recent determination of Rayleigh wave dispersion curves from angular distributions exploiting the kinematical focusing effect. A short review is then presented on the direct measurement of surface phonon dispersion curves. A comparison is made with the existing theories of surface phonons in ionic crystals. The one photon energy loss spectra of He scattering from LiF(001) calculated for a hard corrugated surface model are found to be in general good agreement with the experimental TOF spectra. Evidernce is obtained that: (i) one-phonon processes are predominant, and (ii) in addition to Rayleigh waves important contributions to the inelastic scattering come from the surface projected density of bulk phonons. Important effects due to inelastic resonances with surface bound states are put in evidence and explained by simple kinematical arguments. The possible observation of surface optical modes in NaF(001) is discussed. (51 refs.)

Nickel carbonyl adsorption on the Ni(111) surface .... See Entry 72247

Enhanced Raman scattering by two-dimensional array of polarisable spheres .... See Entry 72788

Infrared observation of intrinsic modes on adsorbent surfaces by photothermal beam deflection spectroscopy .... See Entry 72812

Elementary surface excitations in insulators and metals. Methods of spectral examination .... See Entry 72878

Simultaneous excitation of rotations and surface phonons in the scattering of D_2 from a NaF crystal .... See Entry 72921

Atom scattering by soft-potential surfaces with one-Rayleigh-phonon exchange .... See Entry 72925

Adsorbate-induced umklapp processes in photoemission from Cl on Cu .... See Entry 72957

Symmetry effects in the electron spectroscopy of metals with an ordered adsorbate overlayer .... See Entry 72960

68.40 SURFACE ENERGY OF SOLIDS; THERMODYNAMIC PROPERTIES

72210 Surface free enthalpy in multilayer surface descriptions. L.Z.Mezey, J.Giber (Inst. of Phys., Budapest Tech. Univ., Budapest, Hungary).
Surf. Sci. (Netherlands), vol.127, no.1, p.L98-101 (April 1983).
The surface free enthalpy is shown to have layer contributions on the basis of the additivity of the free enthalpy function. The contribution of the topmost layer is shown to be the largest by theoretical considerations. Numerical calculations on real binary alloys show that only about 0.01-0.10% is associated with the layers under the topmost one. (6 refs.)

68.45 SOLID-FLUID INTERFACE PROCESSES

(see also 82.65 Sorption and accommodation coefficients)

72211 Thermally induced negative ion ESD. J.H.Craig,Jr. (Dept. of Phys., Univ. of Nebraska, Omaha, NE, USA).
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.382-6 (March 1983).
Electron stimulated desorption of O^- has been observed from oxygen on platinum. Negative ion ESD is not observed during oxygen uptake at 300K. However, O^- emission occurs during heating after oxygen exposure. Comparison is made with previously measured O^+ ESD from this system. The negative ion results are discussed in terms of electron attachment and polar dissociation mechanisms. An ion energy distribution for O^- is also presented which exhibits a peak considerably broader than the previously measured O^+ IED. (11 refs.)

72212 Molecular dynamics study of the interlayer water in phyllosilicates. P.Demontis, E.S.Fois, A.Gamba, B.Manunza, G.B.Suffritti (Inst. of Phys. Chem., Univ. of Sassari, Sassari, Italy).
THEOCHEM (Netherlands), vol.10, p.245-54 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
A preliminary molecular dynamics study of the interlayer water in montmorillonite was performed by using a central force interaction model. The structural properties of the system, deduced from distribution functions, and the IR spectrum of water, calculated by Fourier transform of dipole moment autocorrelation function, are presented and compared with experimental data. (25 refs.)

72213 Anomalous sorption kinetics curves and Fick diffusion. M.A.Mirkin (Leningrad Gov. Univ., Leningrad, USSR).
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.3, p.197-200 (1983). In Russian.
The absorption of liquids by polymers in a state of strain is governed by a diffusion coefficient which is time dependent, and determined by relaxation processes of relatively long duration. A modified form of Fick's diffusion law is proposed to account for this phenomenon, which predicts absorption curves with points of inflexion. The modified equation is used to model water absorption by isotactic polypropylene at 6×10^4 kPa pressure and 293K. It is shown that the model can be fitted closely to experimental data. These data cannot be fitted by the classic Fick's law equation. (1 ref.) *C.J.S.*

72214 Adsorption of oxygen and cesium by lanthanum hexaboride. D.A.Gorodetskii, V.K.Tskhakaya, Yu.G.Shchudlo, V.I.Yarygin, A.A.Yask'ko.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.6-10 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1224-9 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Slow electron diffraction and Auger electron spectroscopy are employed to investigate adsorption of oxygen on the surface of LaB_6(100). Oxygen forms a c (2×2) structure in the process of adsorption at room temperature. (7 refs.)

72215 Use of SED method to investigate phenomena on ordered and defect parts of single-crystal surfaces. D.S.Rumi, S.Zh.Nimatov (Arifov Inst. of Electronics, Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.15-19 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1235-9 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Slow electron diffraction (SED), electron-stimulated desorption (ESD), and mass spectrometry in an ultrahigh vacuum are used to investigate the phases of oxygen adsorption on a real (111) surface of Si single crystal. (9 refs.)

72216 Adsorption and electron state of CO, NO, and O_2 on Pt and Ir: Investigation by photoelectron spectroscopy and thermodesorption. A.I.Boronin, P.A.Zhdan (Inst. of Catalysis, Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.27-31 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1247-51 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors have employed electron spectroscopy and thermodesorption to investigate the electron state of CO, NO and O_2 adsorbed on the surface of recrystallized Pt and Ir foils. Comparison of the data obtained by these methods made possible a detailed characterization of the state of the adsorbates, and also an examination of the processes that take place on Pt and Ir surfaces in the temperature range 300-800K. (16 refs.)

72217 Adsorption and electroadsorption of oxygen on {111} and {113} faces of monocrystalline germanium. T.P.Smirnova, V.G.Ivanov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.32-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1252-5 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Field-emission microscope studies of adsorption of oxygen on germanium have revealed a substantial increase in the adsorption rate when a strong electric field of autoionic sign is present. It has been shown that, under these conditions, there is a marked change in the form of the field-emission (FE) image of a germanium surface that has been cleansed by desorption by an electric field, and also that has been heated at the temperature of final rearrangement. In the neighborhood of the {100}, {111} and {113} faces weakly emitting areas appear, the integral current decreases substantially, and the increase in the work function amounts to 1.8 eV. These changes have been accounted for in terms of changes in the nature of filling of the germanium surface in a strong electric field and formation of a dense adsorption covering as a result of the fact that strong electron fields deform and disrupt the bonds on the surface and in the surface region of semiconductors, and increase the number of adsorption centers. (5 refs.)

72218 Adsorption of lithium on the surface of germanium single crystal. G.I.Bigun, I.D.Nabitovich, Yu.S.Sikhorskii (Lvov Polytech. Inst., Lvov, Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.36-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1256-9 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The field-emission method is used to investigate adsorption of lithium on the surface of the (100) and (111) faces of germanium single crystal. The concentration dependences of the work function and the binding energy for 'zero' covering are obtained. (15 refs.)

72219 Adsorption of barium on the (110) and (111) faces of molybdenum. U.V.Azizov, S.T.Sabirov, S.T.Dzhalilov (Lenin Tashkent State Univ., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.40-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1260-4 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors investigate adsorption of barium on the (110) and (111) faces of molybdenum by the methods of thermoelectronic emission and surface ionization of cesium. It is established that adsorption of barium for constant concentration on the (110) and (111) faces of Mo is of a reconstruction nature with increasing substrate temperature. (11 refs.)

72220 Some features of thermodesorption of oxygen from molybdenum. U.V.Azizov, V.S.Gutov, Ya.R.Sagatov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.45-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1265-8 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Thermodesorption and electron-stimulated desorption employing a time-of-flight mass spectrometer as a partial pressure detection are used to investigate the kinetics of oxygen adsorption on molybdenum. (7 refs.)

72221 Adsorption of aluminum on low-resistance gallium arsenide. E.I.Blazhnova, N.V.Mileshkina, G.B.Nazarov (Leningrad State Univ., Leningrad, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.194-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1420-2 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Adsorption of aluminum was investigated using low-resistance crystals of n-type gallium arsenide with a resistivity $\rho\sim10^{-3}$ ohm.cm, $n=8.6\times10^{17}$ cm^{-3}, and tin doping. The surface of single crystals, cut in the ⟨111⟩ direction, was purified by desorption using a strong electric field in a hydrogen atmosphere. GaAs field-emission cathodes manufactured in this fashion were characterized by stable emission and reproducible volt-ampere characteristics (VAC) of the field-emission current. When aluminum was deposited on the reference tungsten tip, the field-emission current increased in accordance with the decrease in the work function of the surface, while the volt-ampere characteristics shifted into the region of lower anode voltages. (7 refs.)

72222 An examination of adsorbed oxygen molecules on Ag(110) by UPS. M.A.Barteau, R.J.Madix (Dept. of Chem. Engng., Stanford Univ., Stanford, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.85-8 (6 May 1983).
The nature of the chemisorbed state of molecular oxygen on Ag(110) was studied by ultraviolet photoemission. The results show that the molecular orbital structure of O_2(gas) is strongly altered in contrast to O_2 adsorbed on aluminum. These results are consistent with previous studies utilizing vibrational spectroscopy. (20 refs.)

72223 An extended Huckel study of hydrogen and oxygen chemisorption on Ru(001) surface. B.C.Khanra, S.K.Saha (Solid State & Molecular Phys. Div., Saha Inst. of Nuclear Phys., Calcutta, India).
Chem. Phys. (Netherlands), vol.76, no.2, p.255-8 (15 April 1983).
Extended Huckel MO theory has been applied to treat the chemisorption of hydrogen and oxygen atoms on Ru (001) surfaces. The site of chemisorption, surface-adatom distance, chemisorption energy and the vibrational frequency of the adatom on the surface have been calculated. For different sites, the chemisorption energy (E_c) results are as follows: For hydrogen, $|E_c|$(centre)$>|E_c|$(top)$>|E_c|$(bridge); while for oxygen, $|E_c|$(bridge)$>|E_c|$(top)$>|E_c|$(centre). These results are critically discussed in the light of recent results obtained from electron energy-loss spectroscopy (EELS) experiments. (25 refs.)

72224 Rotationally mediated selective adsorption as a probe of isotropic and anisotropic molecule-surface interaction potentials: HD(*J*)/Ag(111). Chien-fan Yu, C.S.Hogg, J.P.Cowin, K.B.Whaley, J.C.Light, S.J.Sibener (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Isr. J. Chem. (Israel), vol.22, no.4, p.305-14 (1982).
Rotationally mediated selective adsorption scattering resonances are used to make an experimental and theoretical study of the laterally averaged interaction potential between HD and a weakly corrugated system, Ag(111). The experimentally observed resonances determine the vibrational levels of the HD/Ag(111) physisorption potential as a function of bound rotational state. These vibrational levels show J-dependent shifts due to the orientational anisotropy of the potential. Exact quantum scattering calculations using a full laterally averaged potential of the form $V_0(z,\theta)=\nu_0(z)[1+\beta P_2(\cos\theta)]$ have been carried out to obtain rotationally inelastic transition probabilities. Experimental and theoretical resonance energies are compared for two forms of $\nu_0(z)$, a Morse and a variable exponent potential, as a function of β, and are found to be very close to the first-order perturbed energies of a free rotor in bound states of $\nu_0(z)$. Both potential forms give equally good fits to the data, yielding an optimum value of the asymmetry parameter, $\beta\approx-0.05$. The determination of β is relatively insensitive to small changes in the $\nu_0(z)$ well depth. (38 refs.)

72225 NonMarkoffian theory of activated rate processes. II. Thermal desorption. A.Nitzan, B.Carmeli (Dept. of Chem., Tel Aviv Univ., Tel Aviv, Israel).
Isr. J. Chem. (Israel), vol.22, no.4, p.360-4 (1982).
For pt.I see Phys. Rev. Lett., vol.49, no.7, p.423 (1982). A model for thermal desorption, described by a one dimensional classical generalized Langevin equation (GLE) for the motion of an adatom, is solved by reducing the GLE to a Fokker-Planck equation in action space. The escape rate is obtained as the inverse mean first passage time for the particle to achieve a threshold energy (or action). A calculation using parameters corresponding to the desorption of Ar from W is compared with quantum mechanical results for the same model. (12 refs.)

72226 Interaction of NO_2 with a Pt(111) surface. J.Segner, W.Vielhaber, G.Ertl (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany).
Isr. J. Chem. (Israel), vol.22, no.4, p.375-9 (1982).
The interaction of NO_2 with a Pt(111) surface was studied by molecular beam and thermal desorption techniques. At 300K NO_2 adsorbs dissociatively

into $NO_{ad}+O_{ad}$ with an initial sticking coefficient $s_0=0.97$. s_0 decreases slightly with increasing surface temperature; the variation of the sticking coefficient with coverage exhibits a marked 'precursor' state behavior. The rate of formation of gaseous NO is limited by desorption of this molecule, i.e. there is no evidence for a direct process $NO_2 \rightarrow NO_g+O_{ad}$. At ≈400K NO desorption is complete and only O_{ad} is building up on the surface. The maximum coverage $\theta_{0,max} \approx 0.77$ is much higher than that so far reported for exposure to O_2 (0.25), which is ascribed to kinetic effects, i.e. a much higher sticking coefficient in the case of NO_2. Two additional states with desorption energies of about 32 and 38 kcal/mol characterize the high oxygen coverage situation. Desorption of O_2 starts above 450K. (27 refs.)

72227 Dynamics of surface atoms and molecules under irradiation. Y.Shapira (School of Engng., Tel Aviv Univ., Ramat Aviv, Israel).
Isr. J. Chem. (Israel), vol.22, no.4, p.386-94 (1982).
Various classes of interactions between surface species and irradiation are discussed. Electron induced decomposition of halides, photon-and electron-stimulated desorption and photodesorption are emphasized. Experimental work, involving a wide range of techniques, has been carried out on different materials whose surfaces can be subject to those interactions, enhancing our insight into the corresponding processes. The data are described in terms of existing and new mechanisms, while the similarities and differences between the various interactions are pointed out. (58 refs.)

72228 Strong adsorption in critical binary mixtures. L.Peliti, S.Leibler (Istituto di Fisica 'G. Marconi', Univ. di Roma, Roma, Italy).
J. Phys. C (GB), vol.16, no.13, p.2635-40 (10 May 1983).
Field theoretical calculations of the order parameter profile in the critical adsorption problem in binary fluids are discussed. The irrelevance of van der Waals interactions with the wall and the validity of the strong adsorption limit are established. Results are compared with those of other existing approaches. (11 refs.)

72229 Transient diffusion kinetics in media exhibiting axial variation of diffusion properties. I. Sorption kinetics. Z.J.Grzywna, J.H.Petropoulos (Phys. Chem. Lab., Democritos Nuclear Res. Centre, Athens, Greece).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.571-84 (April 1983).
Transient unidimensional sorption of a penetrant in a medium exhibiting a gradation in diffusion properties along the diffusion axis is considered. The effect of the mode and extent of the variation in diffusion properties on the kinetics of both 'symmetrical' and 'unsymmetrical' sorption processes is investigated systematically by numerical solution of a number of carefully chosen representative cases. A previous asymptotic analytical treatment is reconsidered, corrected where necessary, and further developed. Its practical usefulness is then assessed by comparison with the corresponding numerical results. The insight thus gained should permit a much more systematic and informative analysis of the transient sorption kinetic behaviour of experimental nonhomogeneous solid-penetrant systems. (13 refs.)

72230 Transient diffusion kinetics in media exhibiting axial variation of diffusion properties. II. Permeation kinetics. Z.J.Grzywna, J.H.Petropoulos (Phys. Chem. Lab., Democritos Nuclear Res. Centre, Athens, Greece).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.585-97 (April 1983).
For pt.I see ibid., vol.79, no.4, p.571 (1983). Transient-state permeation of a penetrant across a slab or membrane exhibiting a gradation in diffusion properties along the diffusion axis is investigated by the methods used in the preceding analogous study of sorption kinetics. Early- and late-time transient permeation kinetics at both upstream and downstream surfaces of the membrane have been examined, in turn, in a systematic manner. Proper analysis of data of this kind (hitherto largely unexploited in experimental practice) is potentially capable of furnishing important information about the mode and extent of the spatial variation of diffusion properties, which partly parallels and partly augments the information deducible from sorption kinetics or permeation time lags. The results of this and the preceding paper provide much of the theoretical background necessary for the practical use of transient-state analysis in a manner analogous to the method of time-lag analysis previously developed. (13 refs.)

72231 Partially dissociative adsorption of water vapor on the Si(111)(7×7) surface. H.Kobayashi, T.Kubota, M.Onchi, M.Nishijima (Dept. of Chem., Kyoto Univ., Kyoto, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.345-6 (9 May 1983).
High-resolution vibrational electron energy-loss spectra have been measured of the Si(111)(7×7) surface exposed to water vapor at 300K. Direct experimental evidence is given that water adsorption on the Si(111)(7×7) surface is partially dissociative. (8 refs.)

72232 Evidence for pseudo bridge bonding of $c(2\times2)$-O on Ni(100). J.E.Demuth, N.J.DiNardo, G.S.Cargill,III (IBM Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1373-6 (2 May 1983).
New low-energy electron-diffraction intensity measurements and dynamical calculations indicate that oxygen in a $c(2\times2)$ overlayer resides 0.80 ± 0.025 Å above the top layer of Ni atoms and is displaced 0.30 ± 0.1 Å from the fourfold hollow position along a $\langle110\rangle$ direction. This produces a structure having C_{2V} symmetry with two inequivalent nearest-neighbor Ni-O bond distances of 1.75 ± 0.05 and 2.14 ± 0.08 Å. (21 refs.)

72233 Adsorption of carbon monoxide on osmium (0001): development of a nonhexagonal structure model. N.Vennemann, E.W.Schwarz, M.Neumann (Fachbereich Phys., Univ. Osnabruck, Osnabruck, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.273-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The chemisorption of CO on osmium (0001) at 200K has been investigated by means of low-energy electron diffraction (LEED) and temperature programmed desorption (TPD). The CO is adsorbed rapidly forming a well-ordered $(\sqrt{3}\times\sqrt{3})$ R30° pattern after an exposure of 2.3×10^{-4} Pa s, corresponding to a coverage of $\theta=1/3$. After an exposure of 2.8×10^{-4} Pa s, an 'intermediate' pattern, corresponding to $1/3<\theta<5/12$, is observed. For larger exposures the overlayer compresses continuously until saturation coverage at $\theta=0.63$ is reached. Due to a combined LEED/TPD investigation, relative coverages could be determined, leading to the suggestion of a nonhexagonal structure model for CO adsorption on Os(0001) in the compression range. A hexagonal structure model could clearly be ruled out. (16 refs.)

72234 Orientation of water adsorbed on Cu(110). C.Mariani, K.Horn (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.279-85 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The method of determining the orientation of an adsorbed molecule by angle-resolved photoemission with polarised light has been applied to the case of water adsorbed on clean copper (110). By using dipole selection rules and symmetry arguments, it is found that in the full monolayer as well as at submonolayer coverages, the water molecules are adsorbed in a tilted geometry. Only small shifts in the valence photoemission peak relative to the gas phase spectrum are found, indicative of a weak chemisorption bond. These results are explained, by recourse to LEED observations, in terms of recent models of water layers on metal surfaces. (15 refs.)

72235 On the interaction of oxygen with Pt single crystals: LEED study of step coalescence. G.Lindauer, P.Legare, G.Maire (Lab. the Catalyse et Chimie-des-Surfaces, Univ. Louis Pasteur, Strasbourg, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.301-6 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Several single crystal faces of platinum, after decontamination, are exposed to oxygen pressures from 10^{-9} to 10^{-6} Torr in a range of temperatures between 25 to 800°C. The adsorption is studied by LEED and Auger spectroscopy. Oxygen is adsorbed on all platinum surfaces. The existence of defects like steps, terraces or ledges strongly facilitates the dissociation and the adsorption of oxygen. On Pt(111) stepped surfaces, two types of (2×2) structures are obtained: one at room temperature, very sensitive to the electron beam, disappears on heating at 100°C in UHV. A more stable (2×2) is observed at 400°C. Under these experimental conditions, a step coalescence and a terrace broadening is induced by oxygen depending on the terrace orientation. For example, the terrace width and the step height are doubled on the Pt[6(111)×(100)]. (11 refs.)

72236 Adsorbate interactions in energetics, structure, dynamics, and kinetics of adlayers: CO and N_2 on Ru(001). D.Menzel, H.Pfnur, P.Feulner (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.374-81 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
In order to show the influence of lateral as well as 'vertical' interactions on adsorbate properties, coverage dependent data for energies and entropies of adsorption, order-disorder transitions, vibrational and electronic coupling, and kinetics of adsorption and desorption are correlated for CO and (partly) for N_2 on Ru(001). These two systems appear to be quite similar in many respects, like TPD spectra, coverage dependence of thermodynamic data, and formation of $\sqrt{3}$ structure, which are all caused by the existence of strong nearest-neighbour (NN) repulsion and weak next-nearest-neighbour (NNN) attraction in both systems. However, completely opposite behaviour is observed for the sticking coefficients, s, as function of coverage. While for CO, s drops sharply between $0.2<\theta<0.33$ at most temperatures, N_2 shows a sudden jump of s to about twice the initial value in the same coverage range. Closer examination shows that the contrary behaviour is connected to the different evolution of the layers in addition to the $\sqrt{3}$ (NNN) coverage. While for CO, compression of the chemisorbed layer sets in after complete filling of the $\sqrt{3}$ structure, resulting in a layer with roughly identical molecules at each coverage, for N_2 a very different binding state close to physisorption is formed even before the $\sqrt{3}$ structure is fully developed. In both cases influences of the properties of the chemisorbed layer (in particular its statistical distribution, as determined by phase transitions) on those of transient precursors or physisorbed species become important. (24 refs.)

72237 Interaction of hydrogen with a palladium (110) surface. M.G.Cattania, V.Penka, R.J.Behm, K.Christmann, G.Ertl (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.382-91 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The adsorption of hydrogen on a Pd(110) surface was investigated using Video-LEED, work function ($\Delta\phi$) and thermal desorption mass spectroscopy (TDS) techniques. At 120K, dissociative adsorption occurs readily with a sticking probability near unity. The formation of a 'true' ordered (2×1) hydrogen phase corresponding to $\theta_H=1.0$ is followed by a (1×2) phase with intense LEED spots indicating a H-induced surface reconstruction. The work function of the clean surface increases continuously with H exposure, up to a saturation value of 325 mV. TDS reveals a total of four hydrogen binding states. Two high-temperature states β_1 and β_2 are produced by chemisorbed H, whereas the low-temperature states α_1 and α_2 only occur on the reconstructed surface and are tentatively attributed to H atoms that have moved to subsurface sites located below the topmost Pd atom layer. The energy splitting of the α states possibly indicates two different kinds of subsurface sites or two different desorption mechanisms; the α_1 site is progressively populated as the surface reconstruction proceeds. (14 refs.)

72238 Temperature programmed field desorption of protonated hydrogen from rhodium and tungsten. N.Ernst, J.H.Block (Fritz-Haber-Inst. der Max-Planck-Gesellschaft, Berlin, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.397-404 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The reaction of hydrogen, induced by an electric field of about 20 V/nm, on rhodium and tungsten field emitter surfaces is investigated by means of mass and appearance spectroscopy equipped with a new scanning technique. Generation of H_3^- on protruding single atoms is studied by comparing surface temperature dependences for H_3^+ and D_3^+ formation rates. Field-adsorbed hydrogen species display different surface-temperature behaviour on W and Rh. This is ascribed to the population of field-induced molecular binding sites which differs for the two metals. The formation of H_3^+ is discussed within the frame of a surface reaction model involving field-adsorbed H_2(f-ad) and chemisorbed H(ad): $H_2(\text{f-ad})+H(\text{ad}) \rightarrow H_3^+(g)+e^-(\text{Me})$. (23 refs.)

72239 Desorption of F and Cl from A (110)Mo surface: binding energies and pre-exponential factors. G.Bolbach, J.C.Blais (Inst. Curie, Section de Phys. et Chimie, Paris, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.405-9 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
A systematic study of the binding energy of halogens on the (110), (100) and (111) Nb, Mo, Ta and W surfaces has been undertaken in order to predict the nature of the chemisorption bonding of such adatoms on transition metal surfaces. The results concerning F and Cl on (110) Mo are presented. Under low coverage conditions ($\theta<10^{-2}$ of a monolayer), first order desorption kinetics have been observed and the mean adsorption lifetime τ has been determined. Since the general expression $\tau=\tau_0 \exp(E/kT)$ is verified in a large temperature range (1700-2300K), the binding energy E and the pre-exponential factor can be deduced: $E(F)=4.6\pm0.1$ eV, $\tau_0(F)=8\times10^{-14}$ s; $E(Cl)=4.1\pm0.1$ eV, $\tau_0(Cl)\simeq5\times10^{-14}$ s. These values are similar to those previously reported on (100) and (111) Mo surfaces; thus for the system studied, the binding energy of a given halogen does not depend on the surface orientation. (13 refs.)

72240 The interaction of CO with Al(111) at room temperature. K.Khonde, J.Darville, J.M.Gilles (Dept. de Phys., Facultes Univ. Notre-Dame de la Paix, Namur, Belgium).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.414-21 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
AES, LEED, low resolution ELS and work function measurements were conducted at room temperature on the interaction of CO with Al(111). Three main stages in the adsorption process were observed. Dissociative adsorption led to the incorporation of oxygen and carbon with the formation of amorphous oxidized and carburized aluminium. The initial state of the sample surface strongly determines the adsorption kinetics. In this framework the authors discuss the effect of structural defects and chemical impurities. (5 refs.)

72241 Kinetics of carbon monoxide adsorption on Re(0001) between 100 and 300K. S.Tatarenko, R.Ducros, M.Alnot (LARIGS, Lab. Maurice Letort, CNRS, l'Univ. de Nancy I, Villers-les-Nancy, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.422-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Carbon monoxide adsorption has been studied by Thermal Programmed Desorption, Auger Electron Spectroscopy and Low Energy Electron Diffraction on Re(0001) between 100 and 300K. Three α states and one β state with first order kinetics are observed. The α species correspond to CO molecularly adsorbed and the β species to molecules partially dissociated. Annealing of the adsorbed layers at several temperatures has shown that the β species is formed during heating process. Coadsorption with O_2 has shown that the CO layer is only adsorbed on some parts of the surface. At saturation the adsorbed layer is compact and adsorption takes place through a mobile precursor weakly bound to the surface. (27 refs.)

72242 Coadsorption of water and ions on Cu(110): models for the double layer. K.Bange, D.Grider, J.K.Sass (Fritz-Haber-Inst. der Max-Planck-Gesellschaft, Berlin, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.437-43 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The coadsorption of oxygen, bromine and sodium with water on Cu(110) has been studied using ultraviolet spectroscopy, thermal desorption spectroscopy, measurements of work function changes and low energy electron diffraction. Compared to the clean surface, these ionic coadsorbates give rise to striking modifications of the adsorption behaviour of water, with a pronounced dependence on submonolayer coadsorbate coverage. Possible electrochemical implications of these results, in particular with regards to the electric double layer formed at the metal-electrolyte interface are briefly discussed. (16 refs.)

72243 Desorption of negative ions on metallic samples by very low energy electrons. M.Bernheim, M.Chaintreau, R.Dennebouy, G.Slodzian (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.610-17 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Electro-stimulated experiments were performed in a classical microscope for secondary ion emission; the immersion collection lens is providing a very good collection of the ions emitted with low initial energies. The electron beam decelerated just as the sample neighbourhood is bombarding the target with a low and easily adjustable energy and with a high density nearly independent of the electron energy. The variations of desorption yields with electron energy and energy distributions of the desorbed ions could be recorded directly. Among the preliminary results one should emphasize: (i) The desorbed H^- yields exhibit a sharp peak at low energies depending on the metal of the sample. (ii) The O^- desorption yield is modified by the electron energy during the adsorption process; the desorption curves show distinct changes in their slopes. (iii) H^- and O^- ions are emitted with very low initial energies; their spread in energy remains nearly independent of the incident electron energy. (7 refs.)

72244 Adsorption of H_2O on Al(111). F.P.Netzer, T.E.Madey (Surface Sci. Div., NBS, Washington, DC, USA).
Surf. Sci. (Netherlands), vol.127, no.1, p.L102-9 (April 1983).
The adsorption of H_2O on Al(111) has been studied by ESDIAD (electron stimulated desorption ion angular distributions), LEED, AES and thermal desorption in the temperature range 80-700K. At 80K, H_2O is adsorbed predominantly in molecular form, and the ESDIAD patterns indicate that bonding occurs through the O atom, with the molecular axis tilted away from the surface normal. Some of the H_2O adsorbed at 80K on clean Al(111) can be desorbed in molecular form, but a considerable fraction dissociates upon heating into OH_{ads} and hydrogen, which leaves the surface as H_2. Following adsorption of H_2O onto oxygen-precovered Al(111), additional OH_{ads} is formed upon heating, and H_2 desorbs at temperatures considerably higher than that seen for H_2O on clean Al(111). The general behavior of H_2O adsorption on clean and oxygen-precovered Al(111) ($\theta_O \lesssim$monolayer) is rather similar at low temperature, but much higher reactivity for dissociative adsorption of H_2O to form OH_{ads} is noted on the oxygen-dosed surface around room temperature. (16 refs.)

72245 Comparison of H^+ and H^- ESD from hydrogen on platinum. J.H.Craig,Jr. (Dept. of Phys., Univ. of Nebraska, Omaha, NE, USA).
Surf. Sci. (Netherlands), vol.127, no.1, p.175-81 (April 1983).
Electron desorption of H^- from H_2 adsorbed on platinum is observed and compared with the corresponding H^+ emission. The H^- signal is observed to track closely with the thermal desorption signal indicating a possible correlation between production of molecular hydrogen prior to desorption and formation of H^- from polar dissociation. The energy distribution and thresholds for H^+ and H^- are observed to be significantly different. The H^- threshold is shown to be 7-8 eV higher than for H^+. (15 refs.)

72246 Small absorbate dipole moments need not imply small charge transfers. N.D.Lang (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Surf. Sci. (Netherlands), vol.127, no.2, p.L118-22 (April 1983).
It is pointed out that small, electronegative adatoms like H and O are able to exhibit very small dipole moments even though they may show appreciable charge transfer. This is true because the spatial separations of charge involved can be far less than 1 Å. (9 refs.)

72247 Nickel carbonyl adsorption on the Ni(111) surface. J.L.Gland, R.W.McCabe, G.E.Mitchell (Phys. Chem. Dept., General Motors Res. Labs., Warren, MI, USA).
Surf. Sci. (Netherlands), vol.127, no.2, p.L123-8 (April 1983).
Overlayers formed by the adsorption of $Ni(CO)_4$ in CO on the Ni(111) surface at 100K were characterized using high resolution electron energy loss spectroscopy and thermal desorption spectroscopy. At temperatures below 135K, molecular nickel carbonyl adsorbs on the CO saturated Ni(111) surface as suggested by several observations. Vibrational transitions characteristic of molecular $Ni(CO)_4$ are dominant. The energy dependence of both the elastic and inelastic electron scattering cross sections are dramatically altered by $Ni(CO)_4$ adsorption. All of the mass spectrometer ionization fragments typical of molecular $Ni(CO)_4$ are observed in the narrow thermal desorption peak at 150K. The inelastic scattering cross sections for both adsorbed nickel carbonyl and adsorbed CO on the Ni(111) surface suggest that a nonresonant dipole scattering mechanism is dominant. (15 refs.)

72248 Interaction of O_2 with low index faces of α-CuZn. S.Maroie, P.A.Thiry, R.Caudano, J.J.Verbist (Lab. de Spectroscopie Electronique, Facultes Univ. Notre-Dame de la Paix, Namur, Belgium).
Surf. Sci. (Netherlands), vol.127, no.2, p.200-22 (April 1983).
The adsorption of O_2 and initial step of oxidation have been investigated, mainly at room temperature, for three different α-CuZn (75%Cu/25%Zn) surfaces (110), (100) and (111) by XPS, XAES, LEED, CPD and HREELS. No superstructures were detected on the LEED patterns during O_2 admission for the three faces, and from the beginning of adsorption Zn segregated to the surface. For (110), the interaction of oxygen follows the sequence: (1) dissociative chemisorption (up to ~20 L), accompanied by an increase of the work function and a single site occupancy as revealed by HREELS; (2) nucleation of ZnO only, indicated by a decrease of the work function, a shift of the Zn $L_3M_{45}M_{45}$ Auger transition and an emergence of a vibration at 550 cm^{-1}, corresponding to the surface phonon of ZnO. The (111) face follows the same scheme, except that the sticking coefficient for oxygen is very low. For (100), it is clear that two states of oxygen exist simultaneously, even at the beginning, as revealed by HREELS and CPD measurements. No copper oxides are ever detected, even after heat treatment. In addition, different bonding properties of OH groups on the three surfaces are reported. (43 refs.)

72249 On the adsorption of oxygen on the Mo{110} surface and its vicinals. E.Bauer, H.Poppa (Stanford/NASA Joint Inst. for Surface & Microstructure Res., NASA Ames Res. Center, Moffett Field, CA, USA).
Surf. Sci. (Netherlands), vol.127, no.2, p.243-54 (April 1983).
The adsorption of oxygen on a Mo{110} surface and four vicinal planes with steps parallel to ⟨100⟩, ⟨110⟩ and ⟨111⟩ directions is studied by Auger electron spectroscopy (AES) and low energy electron diffraction (LEED). The work has the goal to elucidate whether O adsorption on Mo{110} is really as different from O adsorption on W{110} as reported, and what is the cause of the apparent discrepancies between the various reported sticking coefficients on stepped surfaces. (18 refs.)

72250 Conditions for stabilization of carbon monoxide near the surface of KCl and KBr crystals. B.M.Trakhbrot (Inst. of Phys., Acad. of Sci., Tbilisi, Georgian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1785-6 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3149-51 (Oct. 1982). [received: April 1983]
During the thermal bleaching of additively colored KCl and KBr crystals various kinds of interactions occur between the electron color centers, molecules adsorbed from the gas phase and impurities in the lattice. This article presents results of optical studies of the conditions for the formation and stabilization of carbon monoxide in KCl and KBr crystals in consequence of the adsorption of CO_2 molecules. (7 refs.)

72251 Desorption of excited atoms and molecules stimulated by synchrotron UV photons. N.Tolk, M.Traum (Bell Labs., Murray Hill, NJ, USA), N.Stoffel, G.Margaritondo.
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.52
Recent observations of atomic and molecular optic radiation due to UV photon stimulated desorption of excited neutrals is discussed. Synchrotron radiation incident on surfaces is found to result in a surprisingly high yield of desorbed excited atoms (H*, Na* and Li*), more than 3 orders of magnitude larger than the yield of desorbed ions. (no refs.)

72252 Multilayer adsorption: a unified picture. M.Wortis, R.Pandit (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), M.Schick.
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.13-27
Reviews the theory of multilayer adsorption on attractive substrates. Emphasis is on understanding the systematics of behavior for a fixed adatom species over a range of adatom-substrate potential strengths. This point of view encompasses both thin and thick films, including coexistence phenomena such as wetting and roughening. Strong substrates exhibit layering and are always completely wet at coexistence. Intermediate substrates are incompletely wet at coexistence at low temperatures but become completely wet above a wetting temperature T_W. Weak substrates have finite gas-phase adsorption for all $T<T_c$. (31 refs.)

Proceedings of the XVIII All-Union Conference on Emission Electronics .... See Entry 69775

Multiphonon surface processes .... See Entry 72207

Growth of a metal island film under conditions of non-steady-state reevaporation of metal adatoms .... See Entry 72262

High resolution transmission electron microscopy investigation of adsorption and growth of Au on ZnTe surfaces .... See Entry 72274

Diatomic molecules and metallic adhesion, cohesion, and chemisorption: a single binding-energy relation .... See Entry 72339

Band structure of an atom adsorbed on a surface; application to the He/Cu(113) system .... See Entry 72466

Electron work function and donor-acceptor properties of nonideal or adparticle-covered metal surfaces .... See Entry 72472

Effect of point defects of metal surface on the electron work function .... See Entry 72473

Study of Ag/Si(111) submonolayer interface. I. Electronic structure by angle-resolved UPS .... See Entry 72499

Test of short range effects in surface enhanced Raman spectroscopy: an elastic tunnelling study of pyridine-metal interfaces .... See Entry 72515

Model of magnetic phase transition in a monolayer of molecules that are chemosorbed on the surface of a nonmagnetic metal .... See Entry 72600

Dielectric relaxation of adsorbed water in microcrystalline cellulose .... See Entry 72733

Effects of underpotentially deposited Tl and Pb submonolayers on the surface-enhanced Raman scattering (SERS) from pyridine at Ag electrodes .... See Entry 72780

The enhancement of Raman scattering, resonance Raman scattering, and fluorescence from molecules adsorbed on a rough silver surface .. See Entry 72784

Enhanced Raman scattering by two-dimensional array of polarisable spheres .... See Entry 72788

Infrared observation of intrinsic modes on adsorbent surfaces by photothermal beam deflection spectroscopy .... See Entry 72812

An electrodynamic theory of the nonadiabatic effects in rate processes for molecules adsorbed on metals .... See Entry 72849

Luminescence of Eu^{3+} and Tb^{3+} ions adsorbed on hydrated layer-lattice silicate surfaces .... See Entry 72851

AES and EELS study of hydrogen adsorption, oxygen adsorption and sulphur segregation on a clean titanium surface .... See Entry 72895

Thermal energy helium scattering from CO/Pt(111) at very low coverages .... See Entry 72920

Rotationally mediated selective adsorption in rigid rotor/rigid surface scattering .... See Entry 72928

The Auger parameter of adsorbed xenon as a probe of surface polarizability .... See Entry 72946

Site determination for palladium on niobium using angle-resolved photoemission .... See Entry 72952

Photoelectron-diffraction analysis of the structure of $c(2\times2)$O on Ni(001) .... See Entry 72953

Adsorbate-induced umklapp processes in photoemission from Cl on Cu .... See Entry 72957

Photoemission from low-dimensional systems .... See Entry 72958

Photoelectron spectroscopic studies of the adsorption geometry on Ni single crystals: $p(2\times2)$, $c(2\times2)$ overlayers on Ni(100) and (2×1) symmetry on Ni(110) .... See Entry 72959

Symmetry effects in the electron spectroscopy of metals with an ordered adsorbate overlayer .... See Entry 72960

Photoemission study of oxygen adsorbed on coldly deposited silver films .... See Entry 72961

Effect of structural defects on the sorption volume and strength of glass reinforced plastics .... See Entry 73131

Study of surface poisoning and regenerating on $LaNi_5$ by sulphides .... See Entry 73361

Adsorption and reactions of CO, NO, H_2 and O_2 on group VIII metal surfaces .... See Entry 73369

^{252}Cf plasma desorption in ion implanted mica .... See Entry 73389

68.48 SOLID-SOLID INTERFACES

(inc. bicrystals; for grain boundaries, see 61.70N)

72253 XPS study of annealed SiO_2/GaAs interfaces. U.Konig, E.Sasse (AEG-Telefunken Forschungsinst. Ulm, Ulm, Germany).
J. Electrochem. Soc. (USA), vol.130, no.4, p.950-2 (April 1983).
SiO_2 has been deposited pyrolytically on GaAs of different orientations. The effects of annealing on these samples has been investigated with XPS. Between SiO_2 and GaAs, additional layers of Ga_2O_3 and As have been formed. Ga diffusion into SiO_2 is found. Orientation effects are discovered: the Ga amount in SiO_2 rises in the sequence from (111)B over (111)A to (100) and the As accumulation at the interface is more pronounced for (100). A simple model for oxidation and diffusion is proposed. (20 refs.)

72254 Structural intergrowths in the calcium lanthanum ferrites: $Ca_xLa_{1-x}FeO_{3-y}$ $(2/3<x<1)$. J.M.Gonzalez-Calbet, M.Vallet-Regi, M.A.Alario-Franco (Dept. de Quimica Inorganica, Univ. Complutense, Madrid, Spain), J.C.Grenier.
Mater. Res. Bull. (USA), vol.18, no.3, p.285-92 (March 1983).
Electron microscopy and diffraction studies of annealed samples in the $Ca_xLa_{1-x}FeO_{3-y}$ system $(2/3<x<1)$ show the existence of disordered intergrowths between $Ca_2Fe_2O_5$ and $(Ca_{2/3}La_{1/3})FeO_{8/3}$. A previous model for the structure of $(Ca_{2/3}La_{1/3})FeO_{8/3}$ is confirmed by high resolution images. Two types of interface boundary between both structures have been found. (13 refs.)

Dislocation behavior in the vicinity of grain boundaries in FCC metals and alloys .... See Entry 71977

The dependence of the friction coefficient on the crystal structure of solids: physical principles .... See Entry 72044

Diatomic molecules and metallic adhesion, cohesion, and chemisorption: a single binding-energy relation .... See Entry 72339

Formation of electron structure of (111) Si-Au boundary .... See Entry 72495

Influence of backside argon implantation on the Si-SiO_2 interface .... See Entry 72511

68.55 THIN FILM GROWTH, STRUCTURE, AND EPITAXY

(for techniques of crystal growth and film deposition, see 81.10 and 81.15)

72255 An ESD and SIMS study of the composition of platinized, antimony-doped tin oxide films. I. G.B.Hoflund, D.F.Cox (Dept. of Chem. Engng., Univ. of Florida, Gainesville, FL, USA), F.Ohuchi, P.H.Holloway, H.A.Laitinen.
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.281-96 (March 1983).
Secondary-ion mass spectrometry (SIMS) and electron-stimulated desorption (ESD) have been used to characterize the composition of antimony-doped tin oxide films before and after a caustic treatment and before and after deposition of platinum. The impurities were identified qualitatively using dynamic SIMS and found to be Li, C, N, Na, Mg, Al, Si, S, K, Ca, Cr, V, Fe, Mn, Ni, Ti and Zn. Both SIMS and ESD demonstrated that hydrogen is a major constituent of these films. Evidence is presented that the caustic treatment hydroxylates the surface and that Sb is segregated at the surface. It appears that platinum desorbs by electron stimulation probably in the form of an oxide species. This may prove useful in probing the composition of supported-metal crystallites. (61 refs.)

72256 Collision of a low-temperature laser plasma with a condensed medium. S.V.Gaponov (Inst. of Appl. Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.139-44 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1170-6 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
Descriptions are given of the processes occurring in the plasma and solid that accompany the collision between a solid and products from laser erosion expanding under vacuum. The following may be decisive under particular interaction conditions: ionic sputtering, radiation-stimulated diffusion, production of amorphous surface layers on annealing in these, and oriented film growth. It is shown that these phenomena can be used in controlling the properties of surface layers ($\Delta L=10\text{-}10^4$ Å). (22 refs.)

72257 Structure of stabilised ZrO_2 vacuum condensates. G.I.Batalin, V.K.Kushkov, O.V.Kachur, M.I.Grechanyuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.3, p.81-3 (1983). In Ukrainian.
Condensates of the ZrO_2-CaO system obtained by electron-beam evaporation and vacuum condensation onto molybdenum substrates were investigated by X-ray diffraction, electron microprobe analysis and scanning electron microscopy. The chemical composition of the vacuum condensates and dependence of the lattice constant of the ZrO_2-base cubic solid solution upon the substrate temperature are presented. (5 refs.)

72258 The effect of implantation of phosphorus into sputtered $MoSi_2$ thin films. T.P.Chow, C.S.Grant, W.Katz, G.Gildenblat, R.F.Reihl (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.933-8 (April 1983).
The effect of phosphorus implantation into DC magnetron sputtered $MoSi_2$ thin films is studied. The structural, compositional, and electrical properties are examined with X-ray diffraction, secondary ion mass spectrometry (SIMS), sheet resistance, and MOS measurements. A higher hexagonal to tetragonal $MoSi_2$ phase transition temperature is observed for implanted films than for unimplanted ones. At high fluence (5×10^{16} ions/cm^2), MoP is detected, with a significant increase in sheet resistance. Isothermal and isochronal annealing indicates a minimum temperature of 950°C, and a maximum fluence of 2×10^{16} ions/cm^2 can be used. Comparative *C-V* measurements show similar MOS characteristics between unimplanted and implanted films. (26 refs.)

72259 Properties of sputtered molybdenum silicide thin films. T.P.Chow, D.H.Bower, R.L.Van Art, W.Katz (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.952-6 (April 1983).
The structural, compositional, and electrical properties of molybdenum silicide (with an Si/Mo ratio between 2 and 2.3) thin films either sputtered from a hot-pressed, composite target or cosputtered from elemental targets are compared. Structural and compositional examination was performed with X-ray diffraction, Rutherford backscattering spectrometry (RBS), and secondary ion mass spectrometry (SIMS). X-ray diffraction revealed that the as-deposited silicide films were essentially amorphous but, after high temperature annealing, contained mostly tetragonal $MoSi_2$. SIMS depth profiling showed that the concentration of carbon and argon is lower in the cosputtered films but that of oxygen is higher than the alloy-sputtered films. This difference is attributed to the target purity and sputtering system configuration. Isothermal and isochronal annealing results in a minimum resistivity of ~100 $\mu\Omega$-cm in both cases. C-V measurements of silicide-gate capacitors with both types of films yielded similar values of work function and surface-state density. (19 refs.)

72260 Column structure of dielectric evaporated layers and some of their properties. T.Chudoba.
Jemna Mech. & Opt. (Czechoslovakia), vol.28, no.3, p.73-6 (March 1983). In Czech.
Problems encountered in applications of dielectric vacuum evaporated films in optics due to the specific structural properties of the deposited films are discussed. One of the main causes of instabilities of the optical parameters is the column structure of the evaporated films. The mechanism of the growth of the dielectric films and the influence of the deposition parameters on the structural and other properties of the films are discussed. These include refractive index, geometrical thickness of the film, transparency, dispersion, adhesion to the substrate, hardness and temperature and chemical stability. Amongst materials discussed are fluorides, sulphides and oxides. *E.D.*

72261 The effects of incorporating fluorine in amorphous germanium-silicon alloy films. R.Dutta, P.K.Banerjee, S.S.Mitra (Dept. of Electrical Engng., Univ. of Rhode Island, Kingston, RI, USA).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.149-57 (April 1983).
The structural, electrical and optical properties of RF sputtered fluorinated amorphous Ge-Si alloy films have been studied as a function of the amount of fluorine incorporated in the films. The results indicate an increased coordination in the binary semiconductor alloys with the increasing fluorine content. Fluorine attaches with extreme preference to silicon over germanium in the alloys. Due to this high preferential ratio, the increase in coordination on fluorination is much less than that observed in fluorinated amorphous silicon. The thermal stability of fluorinated alloys is found to be higher than similarly prepared hydrogenated samples. (8 refs.)

72262 Growth of a metal island film under conditions of non-steady-state reevaporation of metal adatoms. A.V.Rogachev, V.I.Lashkevich, V.V.Kharitonov (Belorussian Inst. of Railroad Engng., Gomel, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.2, p.943-7 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.315-19 (Aug. 1982). [received: April 1983]
Taking into account the non-steady-state reevaporation of adatoms, the article solves the problem of diffusion growth of a system of uniformly distributed nuclei of the metallic phase. An expression describing the kinetics of change of the zone of nuclei capture is obtained. (9 refs.)

72263 Vapor phase epitaxial growth of ZnSe films. T.Muranoi, M.Furukoshi.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.69-76 (1982). In Japanese.
Epitaxial layers of ZnSe have been grown on GaAs substrate using metallic Zn and metallic Se as the sources. The epitaxial growth was successful at temperatures T_{sub}:370 to 800°C. The thermal etching of the substrate in H_2 flow was necessary when the growth temperatures were in the range 370 to 450°C. When the substrate temperature and one of the source temperatures were fixed, the growth rate increased with the other source temperature and then saturated. Below the saturation point, the growth rate is proportional to the flow rate of each source material. Low resistivity films (of the order of 1 Ω.cm) were obtained at temperatures above 450°C. An electron probe microanalyser was used to determine the impurity profiles on the cleaved surfaces. Gallium and arsenic atoms were distributed exponentially throughout the films grown at 650 to 800°C with the concentration of 10^{20} cm^{-3}. The

gallium concentration was higher than the arsenic concentration. The resistivity of ZnSe on GaAs grown at temperatures 650 to 800°C became low because of Ga autodoping. (11 refs.)

72264 The effect of a continuous etch on the growth rate and morphology of InP prepared by the vapour phase epitaxial-hydride method. T.E.Erstfeld, K.P.Quinlan (Rome Air Dev. Center, RADC/ESM, Hanscom AFB, MA, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.647-62 (July 1982). [received: Nov. 1982]
A study of the effect of a continuous in situ etch of HCl on growth rate and the properties of epitaxial InP layers prepared by the vapour phase epitaxial-hydride technique is reported. Growth rates were determined as a function of the following variables: HCl flow rates in the mixing and source zones PH_3 flow rates, and mixing zone temperatures. Epitaxial InP structures with good morphology were obtained when the continuous HCl etch was varied between 0.8 and 1.5 cc/min. The average values (77K) of the carrier concentrations and mobilities were 1.3×10^{15} cm^{-3} and 23000 cm^2 V^{-1} sec^{-1}, respectively. The study indicates that the continuous in situ HCl etch improves the quality of epitaxial InP layers. (24 refs.)

72265 Growth and characterization of Si doped vapor phase epitaxial GaAs for MESFET. M.Feng, V.K.Eu, T.Zielinski (Torrance Res. Center, Hughes Aircraft Co., Torrance, CA, USA), J.M.Whelan.
J. Electron. Mater. (USA), vol.11, no.4, p.663-88 (July 1982). [received: Nov. 1982]
Describes the Si-doping of GaAs that was grown using the $AsCl_3$:H_2:GaAs, Ga chemical vapour deposition process. The doping sources were $AsCl_3$:$SiCl_4$ liquid solutions which proved to be highly reproducible for Si doping within the range, 1×10^{16} to 2×10^{19} cm^{-3}. Incorporation of Si into the GaAs apparently occurs under near equilibrium conditions. This point is considered in detail and the consequences experimentally utilized to grow n, n^+ bilayers using a single $AsCl_3$:$SiCl_4$ doping solution. Si impurity profiles based upon differential capacitance and SIMS data are presented. These can be very abrupt for n, n^+ structures with order of magnitude changes occurring within 500 Å. For the 1×10^{16} to 8×10^{18} cm^{-3} doped samples the mobilities at 78 and 298K are comparable with the higher values reported for GaAs thin films grown by CVD. Power FET devices made from this material have demonstrated an output density of 0.86 watts/mm at 10 GHz. (20 refs.)

72266 Surface reaction of GaAs vapour phase epitaxy. H.Watanabe, T.Mizutani (Fundamental Res. Labs., Nippon Electric Co. Ltd., Kawasaki, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1216-25 (Nov. 1982). In Japanese. [received: March 1983]
In a review of GaAs vapour phase epitaxy the adsorption and reaction process whereby the surface layer matches the underlying crystal is examined. Research on the vapour phase epitaxial growth reaction depends on the measurement of reaction speed on adsorption, adsorption estimating and modeling and surface cover ratio calculation. From the adsorbed molecule distribution the atomic molecule distribution can be seen. All the available models and their theoretical basis are reviewed and evaluated. (33 refs.) *M.O.*

72267 Characterisation of compound semiconductor epitaxial layers. T.Ikoma, M.Taniguchi (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1226-37 (Nov. 1982). In Japanese. [received: March 1983]
The degree of mobility, purity of doping and deep layer comparison and estimation from the surface of compound semiconductor (II-V group) epitaxial layers are reviewed. Data on epitaxial layers of GaAs, $Al_xGa_{1-x}As_yP_{1-y}$ prepared using the LPE, VPE, MOCVD and MBE methods are discussed. InP, $In_xGa_{1-x}As$, $In_xGa_{1-x}As_yP_{1-y}$ are similarly reviewed and compared. The epitaxial methods used are evaluated. (140 refs.) *M.O.*

72268 The future of molecular beam epitaxy. K.Takahashi (Dept. of Phys. Electronics, Tokyo Inst. of Technol., Tokyo, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1295-6 (Nov. 1982). In Japanese. [received: March 1983]
Molecular beam epitaxy has entered the application phase because of its controllability and accuracy. Analogies are drawn between molecular beam epitaxy and current genetic engineering research. Advances in HEMT, band engineering and MOCVD are briefly outlined. (no refs.) *M.O.*

72269 Surface defects of closed-system-grown $Cd_xHg_{1-x}Te$ epitaxial layers. V.I.Ivanov-Omskii, V.K.Ogorodnikov, V.D.Rozumnyi (A.F. Ioffe Phys.-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.71-4 (16 March 1983).
The interaction of the surface of the $Cd_xHg_{1-x}Te$ epitaxial layers grown by liquid phase epitaxy in a closed system with the vapor phase is studied. Depending on the actual system cooling procedures after the decanting of the solution, defects are found which appear on the epilayer surface in the form of drops of solidified solution or pits. These defects originate from processes associated with the condensation of the solution vapour. Planar surface epilayers can be obtained by properly controlling these processes. (6 refs.)

72270 Formation process in MnBi thin films by Williams' method. Y.Iwama, Y.Takeno (Dept. of Crystalline Materials Sci., Nagoya Univ., Nagoya, Japan).
Phys. Status Solidi a (Germany), vol.76, no.1, p.75-83 (16 March 1983).
Williams has found that when Mn and Bi are successively evaporated on a glass substrate, followed by prolonged annealing around 300°C, a ferromagnetic MnBi thin film can be obtained with its *c*-axis perpendicular to the film plane. In order to elucidate the formation process of the film, Rutherford backscattering (RBS) experiment, X-ray diffractometry, electron microscope study, and magnetic measurement are carried out. It is found that at the first stage of annealing up to 250°C a non-magnetic transitional compound $Mn_{1.2}Bi$ is formed, and during the subsequent annealing at 250°C, the final MnBi crystals with the aligned *c*-axes nucleate, and grow at the expense of the transitional phase. It seems likely that the last stage of reaction, a few Bi crystals remaining in the transitional phase may serve as the nuclei. (5 refs.)

72271 The lattice-pulling effect induced by the film stresses. Conditions of existence and discovery. Yu.B.Bolkhovityanov (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.85-93 (16 March 1983).
The growth conditions at which the lattice-pulling effect may be observed are examined. It is shown that there are different reasons such as the initial supercooling, the great growth velocity, and the non-prognosticated introducing of the substrate constituents into the liquid which can change the solid composition of a film expected during its growth. (21 refs.)

72272 Epitaxial regrowth of Si implanted (100) and (211) GaAs. R.S.Bhattacharya (Univ. Energy Systems, Dayton, OH, USA), A.K.Rai, S.C.Ling, P.P.Pronko.
Phys. Status Solidi a (Germany), vol.76, no.1, p.131-6 (16 March 1983).
Rutherford backscattering-channeling and transmission electron microscopy are used to investigate the annealing behavior of Si implanted GaAs layers. Undoped GaAs wafers of (100) and (211) orientations are implanted with 60 keV Si^+ ions to a dose of 1×10^{15} cm^{-2}. Capless, proximity annealing is performed in the temperature range 200 to 550°C. Two distinct annealing stages are observed for (100); one at 250°C which is associated with the onset of solid phase epitaxial growth and the other at 450°C which can be related to the annealing of microtwins. For (211), although the epitaxial regrowth starts at 250°C, the damage recovery rate is much slower compared to that for (100). Microtwins are the main residual defects after low temperature annealing in both (100) and (211) crystals. However, the microtwins are found to be more stable in (211) as compared to that in (100). (10 refs.)

72273 Isothermal liquid phase epitaxy. V.N.Lozovskii, V.P.Popov, N.V.Vlasenko (Novocherkassk Polytech. Inst., Rostov Region, USSR).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.1, p.47-57 (1983).
The epitaxial growth of semiconductor solid solutions from a liquid phase appears to be possible under stringent isothermal conditions. The driving force of such epitaxy can be liquid phase supersaturation caused by isothermal mixing of liquidus solutions or supersaturation in the solid phase resulting from thermodynamic nonequilibrium of the substrate and the solution. The feature of the method is that film growth requires no control temperature and time of crystallization, while the film properties are set by the initial process conditions. Isothermal liquid phase epitaxy (ILPE) makes it possible to form hyperfine films whose component distribution can be controlled. ILPE inevitably starts on the initial stage of a common liquid phase epitaxy, therefore this phenomenon must be taken into consideration. The above mentioned factors account for the practical importance of the ILPE technique for modern electronics. The present paper reviews the mechanism as well as the main regularities of ILPE for A^3B^5 ternary alloys. (31 refs.)

72274 High resolution transmission electron microscopy investigation of adsorption and growth of Au on ZnTe surfaces. M.Shiojiri, N.Nakamura, C.Kaito (Dept. of Phys., Kyoto Tech. Univ., Kyoto, Japan), T.Miyano.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.719-26 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The monolayer adsorption and the epitaxial growth of Au on the surface of ZnTe crystals have been examined by means of a multibeam lattice imaging technique in a 200 kV electron microscope with a pole piece of $C_s=1.2$ mm and by simulation using the multislice method. Au was vacuum-deposited to an average thickness of 0.5 nm onto 10 nm thick ZnTe films. It has been found that Au atoms are adsorbed on the Zn atoms of the (001)ZnTe surface to build a 1×1 monolayer structure. From the lattice images of the Au island particles together with those of the ZnTe substrates, the epitaxial relations and more precisely the positions of the Au lattice with respect to the substrate ZnTe lattice have been established. (10 refs.)

72275 Mechanism of coalescence of metal particles on a substrate. A.N.Pilyankevich, V.A.Mel'nikova (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.741-6 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.68-74 (Sept. 1982). [received: March 1983]
Acids were chosen as activators of transformations, and the mechanism of the process was investigated in discontinuous films of precious metals—gold and silver—in which islet growth takes place practically uniformly on the whole surface of a substrate. Films were applied to amorphous carbon and glass plates and to cleaved surfaces of ionic Ca_2 and NaCl single crystals by thermal vacuum deposition at a residual pressure of 2×10^{-3} Pa. It is concluded that the most acceptable model of the mechanism of metal particle coalescence in electrolytes is that of bulk migration of particles over the substrate surface, followed by their coalescence of agglomeration during collisions. (15 refs.)

72276 Metastable BCC phase in sputtered Fe-Ni alloys. K.Sumiyama (Dept. of Metal Sci. & Technol., Kyoto Univ., Kyoto, Japan), M.Kadono, Y.Nakamura.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.190-4 (April 1983).
$Fe_{1-x}Ni_x$ alloy films obtained by the RF sputtering technique have been investigated by X-ray diffraction, magnetization and Mossbauer effect measurements. The single BCC phase extends up to about $x=0.4$, a BCC-FCC mixed phase appears for $0.4<x<0.5$ and a single FCC phase predominates for $x>0.5$. The lattice constants of the BCC and FCC phases are slightly larger than those of the bulk specimens. As a result of the BCC phase extension, both the magnetic moment and the Mossbauer spectrum of the Fe-Ni sputtered alloys change smoothly even in the BCC-FCC phase boundary region, in contrast to the results for bulk Fe-Ni alloys. (16 refs.)

72277 The investigation of zinc oxide film photodestruction by means of surface polariton spectroscopy and X-ray diffraction analysis. G.I.Dovbeshko, S.V.Ogurtsov, G.A.Puchkovskaya, M.T.Shpak.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.591-5 (April 1983). In Russian.
Surface polariton spectroscopy and X-ray diffraction analysis were employed to study laser radiation ($\lambda=0.63$ μm) effect on the ZnO film structure. Strong mechanical stresses were found in the films after radiation, which is associated with oxygen vacancies. The changes occurring in the ZnO film structure after laser radiation may be decreased by thermal annealing in a oxygen atmosphere. A conclusion is made that the X-ray diffraction analysis and surface polariton spectroscopy are sensitive methods for investigation of structural changes in films and laser annealing may be used for creating films with prescribed properties. (5 refs.)

72278 Effects of co-depositing oxygen on the growth morphology of (111) and (100) Al single crystal faces in thin films. P.B.Barna, F.M.Reicha, G.Barcza, L.Gosztola, F.Koltai (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.25-30 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Correlation between the growth surface structure and the oxygen-to-aluminium flux ratio was found in vapour deposited Al films. Studies of the effect of co-depositing oxygen species on the growth surface structure were carried out in the case of epitaxially grown Al films (on NaCl, mica and GaAs substrates) containing crystals of (111), (100) and (110) orientations. On (111) crystal faces bunches of growth steps decorated by pinning sites, dents, macro steps correlating to grain boundaries and hillocks were developed. However, on (100) and (110) crystal faces only dents have been found. These results help to explain the correlation between the crystal face anisotropy in the surface micro-chemistry and anisotropy in the participation of

oxygen species in the growth mechanism on the various crystal faces. Whiskers and mushroom whiskers' were detected in Al films deposited at high level of oxygen contamination on amorphous substrates at first. Their formation can be ascribed also to these phenomena. (18 refs.)

72279 Investigation of metal evaporation by mass spectrometry. P.Glaser, E.Szigeti (Industrial Res. Inst. for Electronics, Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.31-4 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Electrical and mechanical properties of thin films are determined in addition to their material composition by the evaporation conditions. One of these conditions is the interaction between vapours and components of the residual gas. The aim of the study is to obtain reproducible film structures. To do this it is necessary to follow and to influence the changes of gas composition during evaporation and to recognize the components of the residual gas which are built into the film. The residual gas composition was investigated with low-resolution mass spectroscopy. The characteristic residual gas composition of the oil diffusion pumped system was determined, and changes of gas composition and partial pressure of certain gases were followed. Structure and electrical properties of films resulting from the controlled evaporation parameters were investigated. (4 refs.)

72280 Structure and electrical properties of amorphous Ni-P thin films [thin film resistors]. E.Besenyei, B.Zsoldos (Industrial Res. Inst. for Electronics, Budapest, Hungary), O.Geszti.
Vacuum (GB), vol.33, no.1-2, p.35-41 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Amorphous Ni-P films were prepared by electroless deposition. Electrical properties (sheet resistivity and temperature coefficient) of the resistance layer deposited on ceramic and glass substrates under various conditions were determined. The structure and morphology of the films were investigated by transmission electron microscopy and electron diffraction. A relationship was found between the structure and the electrical properties. In addition the effect of annealing, carried out at different temperatures, on the electrical properties of the resistance layer was studied. (10 refs.)

72281 Segregation phenomena in thin NiCr layers [thin film resistors]. M.Koltai, I.Trifonov, M.Czermann (Industrial Res. Inst. for Electronics, Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.49-52 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
In the case of NiCr resistor layers sputtered or evaporated a certain change occurs in their structure in the course of heat treatment and reactive deposition. The degree of this change depends on the parameters of deposition and heat treatment and it has a great effect on the TCR of the resistor layers. The depth profiles and electron-optical studies show a segregation of alloy components. Comparing the results of AES and electron-optical examinations to electrical parameters the authors can explain the positive shift of the TCR values by the segregation of the poorly conducting phases from the inside of the layers. (4 refs.)

72282 Electron microscopic and AES studies on thin layers of NiCr [thin film resistors]. L.Toth, A.Barna, G.Safran, M.Menyhard, T.Koranyi (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.111-15 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
In order to understand the parameters affecting the properties of NiCr resistors prepared by various methods, the annealing properties of NiCr thin films were studied. TEM and electron diffraction were used to determine the structure of the films deposited onto SiO_x coated microgrids, while electrical measurements and AES in-depth profiling were carried out on the samples deposited under identical conditions onto silica substrates. The effect of a SiO_x protective coating on the structural changes was investigated during high temperature annealing in vacuum. In the NiCr samples annealed without a protective layer the selective oxidation of chromium led to a rather metallic type of conduction, while in the protected samples the stabilization of the conduction was observed after the same annealing. By hindering oxidation and surface diffusion processes the protective layer resulted in the development of a more stable structure in the NiCr films. (11 refs.)

72283 Diataxy (graphoepitaxy) and other approaches to oriented crystallization on amorphous substrates. E.I.Givargizov, N.N.Sheftal, V.I.Klykov (Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
In book: *Current topics in materials science. Vol.10*, E.Kaldis [Ed.], p.1-53. Amsterdam, Netherlands: North-Holland (1982), vi+515 pp. [0 444 86321 4]
This review has shown how numerous and diverse the approaches are to oriented crystallization on amorphous substrates. In this diversity, two factors involved stand out as decisive for the oriented crystallization: the close-packed crystallographic planes and the presence of a liquid phase (melt or solution). The role of the first factor is, in general, understood. As for the second factor, its mechanism is far from clear. Many authors refer to the mobility of the atoms and/or crystallites on liquid surfaces. However, a drastic reduction of the surface energy for crystalline faces contacting a liquid phase seems to be also a very important factor in the oriented crystallization: this reduction facilitates two-dimensional nucleation and, hence, favors the layer growth mechanism and the orientation of overgrowth. (118 refs.)

Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society .... See Entry 69783

Growth and characterization of Cd-doped InGaAsP/InP double heterostructure lasers .... See Entry 71125

Reduction of dislocations in LPE layers due to the action of thermal stresses .... See Entry 71961

Changes in the physical properties and structure of a semiconductor produced by pulsed laser radiation .... See Entry 72008

Analysis of mercury cadmium telluride by energy dispersive analysis .... See Entry 72129

Study of organic surfaces with UPS and metastable deexcitation spectroscopy .... See Entry 72202

High mobility in liquid phase epitaxial InGaAsP free of composition modulations .... See Entry 72521

Microstructure and electro-optical properties of evaporated indium-oxide films .... See Entry 72522

Superconducting properties of metallic heterostructures .... See Entry 72554

Electron microscopic and ellipsometric studies on oxidized aluminium layers .... See Entry 72761

Special features of photoluminescence of GaAs films produced by molecular-beam epitaxy .... See Entry 72848

Cathodoluminescence of anodically grown SiO_2 films .... See Entry 72874

Elementary surface excitations in insulators and metals. Methods of spectral examination .... See Entry 72878

Interaction between thin films of barium and epitaxial crystals of strontium oxide .... See Entry 72935

Temperature gradient zone melting .... See Entry 72986

Blue sputtered iridium oxide films (blue SIROFs) .... See Entry 72988

Growth of single crystal epitaxial silicides on silicon by the use of template layers .... See Entry 72992

How to place a Knudsen source to obtain optimal uniformity of film thickness on a spherical substrate holder .... See Entry 72993

Thermodynamic optimisation in CVD processes involving candidate materials for photovoltaic solar energy conversion and for space applications .... See Entry 72994

Silicon-germanium alloy growth control and characterization .... See Entry 72996

Recrystallization of amorphous and small grain size polycrystalline silicon .... See Entry 72998

An optical emission study of the glow-discharge deposition of hydrogenated amorphous silicon from argon-silane mixtures .... See Entry 73000

Annealing effects in a-Si:H thin films prepared by glow discharge method .... See Entry 73002

An investigation of microcrystalline films produced by a DC glow discharge in silane and hydrogen .... See Entry 73003

The growth of Cu_2S on polished or etched single crystal CdS substrates [for photovoltaic cells] .... See Entry 73004

Electrochemical nucleation and growth of silicon in molten fluorides .... See Entry 73005

A study on electroless plating of cobalt alloy films for perpendicular recording .... See Entry 73006

The effect of some additives on electroless copper deposition .... See Entry 73007

Electrodeposition of conducting transition metal oxide/hydroxide films from aqueous solution .... See Entry 73008

Tin(IV)-based photoselective metal deposition of cobalt and nickel from alkaline baths .... See Entry 73009

The effect of pH on electroless copper deposition .... See Entry 73010

The colour of gold and gold alloy electrodeposits .... See Entry 73012

Depot de couches polycristallines de silicium sur un substrat conducteur a partir de la phase liquide (Deposition of polycrystalline Si films on conducting substrates from the liquid phase) .... See Entry 73016

Stability of film casting of power-law liquids .... See Entry 73060

The relationship of oxide film thickness and composition on titanium to the absorption coefficient on laser irradiation in an oxidizing atmosphere .... See Entry 73255

Use of secondary ion emission for investigating the distribution profiles of elements and compounds in various film compositions .... See Entry 73382

Nouvelles methodes de preparation de materiau semi-conducteur cellules solaires Cu_2S-CdS (New methods for the production of the solar cell semiconductor material Cu_2S-CdS) .... See Entry 73439

68.60 PHYSICAL PROPERTIES OF THIN FILMS, NONELECTRONIC

72284 Calorimetric studies of molecular layers of yellow arsenic. A.N.Rodionov, R.I.Kalendarev.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.111-14 (1983). In Russian.
Differential thermal analysis has been employed for studying phase transitions in molecular layers of yellow arsenic deposited on a substrate at 203K. The enthalpy change in reversible endothermic transition $As^1(I) \rightleftarrows As^2(I)$ was found to be equal $\Delta H_1 = 0.49 \pm 0.06$ kJ/mole, that of entropy $\Delta S_1 = 2.2 \pm 0.3$ J/K.mole; the enthalpy change for irreversible exothermic phase transition $As^2(I) \rightarrow As(II)$ (amorphization of yellow arsenic) was found to be equal to $\Delta H_2 = -(7.1 \pm 0.5)$ kJ/mole. The activation energy of the process was determined from amorphization kinetics and found to be equal to $E_a = 0.48 \pm 0.07$ eV. It is suggested that the enthalpy of amorphization of yellow arsenic is basically due to deformation of the As_4 molecule. (9 refs.)

An ultrasonic bridge for the study of viscoelastic properties of thin interface films .... See Entry 71321

Blue sputtered iridium oxide films (blue SIROFs) .... See Entry 72988

68.70 WHISKERS AND DENDRITES: GROWTH, STRUCTURE, AND NONELECTRONIC PROPERTIES

Effects of co-depositing oxygen on the growth morphology of (111) and (100) Al single crystal faces in thin films .... See Entry 72278

68.90 OTHER TOPICS IN THE STRUCTURE AND NONELECTRONIC PROPERTIES OF SURFACES AND THIN FILMS

72285 Diffusion-controlled deposition on fibers and surfaces. P.Meakin (Central Res. & Dev. Dept., E.I. du Pont de Nemours & Co. Inc., Wilmington, DE, USA).
Phys. Rev. A (USA), vol.27, no.5, p.2616-23 (May 1983).
Monte Carlo simulations have been carried out to investigate the deposition of particles on surfaces and fibers under conditions where the deposition is diffusion controlled. Deposits prepared under diffusion-controlled conditions have a completely different morphology from deposits prepared under conditions where diffusion is not important. For the case of deposition on thin fibers the authors find that the radius of gyration of the deposit is related to the number of particles in the deposit (N) by $R_g \sim N^\delta$ ($\delta = 0.665 \pm 0.030$) in the limit of large N and long fibers. Consequently, deposits formed on fibers under diffusion-controlled conditions have fractal characteristics similar to

those associated with clusters formed under diffusion-controlled conditions. Similar but less quantitative results are presented for surface deposits. For two-dimensional deposits grown on a one-dimensional 'surface' under diffusion-controlled conditions, the root-mean-square thickness (T) of the deposit is related to the number of particles by $T \sim N^{\varepsilon}$ ($N \to \infty$). The exponent ε has the value 1.30±0.075. Similar results were obtained in three-dimensional simulations of diffusion-controlled deposition on a surface ($T \sim N^{\varepsilon}$, with $\varepsilon = 1.70 \pm 0.2$). All of the results reported in this paper were obtained using two- and three-dimensional lattice models. The results suggest that the structural characteristics of systems grown by diffusion-controlled processes are determined mainly by the dimensionality of the space in which the growth is occurring and are insensitive to geometric variables such as 'surface' curvature. (8 refs.)

Melting and freezing in two dimensions: a molecular dynamics study …… See Entry 72086

Ortho-para conversion of hydrogen molecules on magnetic surfaces …… See Entry 72653

70.00 CONDENSED MATTER: ELECTRONIC STRUCTURE, ELECTRICAL, MAGNETIC, AND OPTICAL PROPERTIES

(see also 81.40R Electrical and magnetic properties related to materials treatment, 81.40T Optical properties related to materials treatment)

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting …… See Entry 69790

71.00 ELECTRON STATES

(see also 63. Lattice dynamics, 73. Surfaces, interfaces, and thin films)

71.10 GENERAL THEORIES AND COMPUTATIONAL TECHNIQUES

72286 Electronic structure factor of disordered materials. D.Belitz, A.Gold (Phys.-Dept., Tech. Univ. Munchen, Garching, Germany), W.Gotze, J.Metzger.
Phys. Rev. B (USA), vol.27, no.8, p.4559-63 (15 April 1983).
The dynamical structure factor of electrons in disordered systems is found to consist of two parts: One part is a disorder-induced elastic contribution with some form factor $S_e(\bar{q})$; the other one is related to the density relaxation spectrum. The authors evaluate $S_e(\bar{q})$ in perturbation theory and the density relaxation within the self-consistent current relaxation theory for two-and three-dimensional systems. For short-range potential fluctuations they find a peak in the static structure factor $S(\bar{Q})$ at $q \simeq 2k_F$. (18 refs.)

72287 Statistics of the levels in small metallic particles. K.B.Efetov (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.467k-75 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.833-47 (Aug. 1982). [received: May 1983]
The problem of the computation of the two-level correlation function in a disordered metal is considered for the case in which the sample is of dimension much smaller than the diffusion length. The supersymmetry method, which allows the problem to be reduced to a problem of the zero-dimensional nonlinear σ model, is used. The symmetry of the collective variable is determined by the presence or absence of magnetic and spin-orbit interactions. It is shown that the correlation function depends on these interactions, and coincides in the various limits with the corresponding correlation functions obtained with the aid of Dyson's hypothesis for orthogonal, unitary, and symplectic ensembles. The computed correlation function determines the response to an external electromagnetic field. (15 refs.)

Correlations and the metal-insulator transition …… See Entry 72309

71.20 ELECTRONIC DENSITY OF STATES DETERMINATIONS

(inc. energy states of liquid semiconductors; see also 65.40 Lattice and electronic heat capacity)

72288 First-principles calculations of cluster densities of states and short-range order in Ag_cPd_{1-c} alloys. A.Gonis (Solid State Sci. Div., Argonne Nat. Lab., Argonne, IL, USA), W.H.Butler, G.M.Stocks.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1482-85 (9 May 1983).
Calculations of the densities of states associated with a particular local configuration of atoms in a substitutionally disordered alloy are reported. An application to Ag_cPd_{1-c} alloys yields detailed information about charge transfer and short-range order in these alloys. (24 refs.)

Electronic, superconducting, and optical properties of technetium from its augmented-plane-wave band structure …… See Entry 72298

Bandwidth narrowing in n-type many-valley semiconductors …… See Entry 72300

Electronic structure of antiferromagnetic MnTe …… See Entry 72304

Density of states and critical resistivity of strongly disordered systems …… See Entry 72358

Electric and photoelectric investigations of β-nickel phthalocyanine thin films …… See Entry 72525

71.25 NONLOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

72289 Theory of electronic structures and lattice distortions in polyacetylene and itinerant Peierls systems. III. Coulomb effects on solitons and effective Coulomb potential in trans-polyacetylene. H.Fukutome, M.Sasai (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.373-95 (Feb. 1983).
For pt.II see ibid., vol.69, no.1, p.1-19 (1983). The authors study effects of the π electron Coulomb interaction on solitons in trans-polyacetylene utilizing the PPP Hamiltonian model developed in preceding papers of this series. Neutral soliton depends only on the on site and nearest neighbour parts of the effective Coulomb potential while charged solitons depend on its all parts. Owing to the Coulomb interaction, neutral soliton has a SDW like polarization cloud, while charged solitons have a CDW like one. The polarization clouds are consistent with ESR, ^{13}C NMR and XPS data. The formation energy of a zwitterionic pair of charged solitons, that gives the photoconductivity threshold, is very sensitively dependent on the strength and shape of the effective Coulomb potential. To get the observed small photoconductivity threshold, the effective Coulomb potential in trans-polyacetylene must have a screened long range part and about 50% screened on site and nearest neighbour parts compared to the one in small conjugate molecules. Such screening of the effective Coulomb potential is essential to make possible splitting of the ^1B_u exciton into a zwitterionic pair of charged solitons. (20 refs.)

AsF_5-doped polyparaphenylene: evidence for polaron and bipolaron formation …… See Entry 72331

Cyclotron resonance of a polaron …… See Entry 72675

71.25C Techniques of band-structure calculation (general theory, applications of group theory, analytic continuation, etc)

72290 On the two-site spinless Falicov-Kimball model with hybridization. J.Zielinski, J.Kowalska (Inst. of Phys., Silesian Univ., Katowice, Poland).
Phys. Status Solidi b (Germany), vol.116, no.2, p.677-83 (1 April 1983).
The exactly solvable two-site extended Falicov-Kimball model is considered. It is shown that the increase of hopping energy lowers the tendency to an abrupt change of the average occupation number of f-electrons. Some thermodynamic quantities are evaluated. The results are used for the alloy analogy coherent potential approximation treatment of the periodic model. (22 refs.)

72291 Electronic states of doped semiconductors: a multiple scattering approach. A.Ghazali, J.Serre (Univ. Paris VIII, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.84-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electronic structure of doped (and compensated) semiconductors is studied by using the Klauder's best multiple-scattering approximation. Electron correlations are also included. It is shown that as the impurity concentration is decreased, the band tail gradually splits off from the main band giving an impurity band. The domains of existence of extended states and localized states have been recognized by analyzing the shape of spectral densities. Lastly, compared results are compared with various experiments. (12 refs.)

72292 Generalized nonmuffin-tin band theory. R.G.Brown, M.Ciftan (Dept. of Phys., Duke Univ., Durham, NC, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4564-79 (15 April 1983).
A new way of applying the nonspherically-symmetric phase-functional method of Williams and van Morgan (1974) to the band-structure problem is derived that results in a generalized (nonmuffin-tin) Green's-function band theory that is variationally stationary and exact in the single-electron, local-potential approximation. The 'near-field' correction, believed to destroy the separability of Green's-function band theories, is implicitly included in the nonspherically-symmetric phase-function basis. This basis is discused in some detail as the authors correct an error in the previous work of Williams and van Morgan. Using this basis to expand the crystal wave function, they obtain an equation that is the most general expression of Green's-function band theory. This equation contains a sum over the structure constants of the Korringa-Kohn-Rostoker method and two 'phase functions' (corresponding to the cosine and sine of the nondiagonal partial-wave shifts) that are independently calculable; hence the effects of structure and cellular potential completely separate. The variational procedure of Kohn and Rostoker then yields a secular determinant that can be solved for the nonmuffin-tin bands and wave functions; the resulting theory is suitable for self-consistent-field applications. (28 refs.)

On the Mossbauer isomer-shift studies of the electronic structure of semiconductors …… See Entry 72722

71.25H Measurement of Fermi surface parameters

(inc. dHvA, magnetoacoustic, position annihilation, and cyclotron resonance studies, etc.)

Electronic, superconducting, and optical properties of technetium from its augmented-plane-wave band structure …… See Entry 72298

Nature of a double magnetoresistance peak observed in magnetic breakdown in aluminium …… See Entry 72375

Two-dimensional electrons in a magnetic field. III. Many-body effects …… See Entry 72463

Superconductivity of alkali metal intercalated $ZrSe_2$ …… See Entry 72559

Electromagnetic excitations in noble metals …… See Entry 72674

Thermoreflectance test of W, Mo, and paramagnetic Cr band structures …… See Entry 72777

71.25J Effective mass and g-factors

Cyclotron resonance study of the conduction band in GaP …… See Entry 72306

'Two-hump' structure and parameters of the X minimum of the conduction band of cubic III-V semiconductors …… See Entry 72308

Connection between the heat capacity and the effective mass of the electrons in Fermi-liquid theory at finite temperatures …… See Entry 72336

About the transfer of the current of majority carriers at the absence of drift field when the avalanche local breakdown of the p-n junction develops …… See Entry 72485

Superconductivity of alkali metal intercalated $ZrSe_2$ …… See Entry 72559

71.25L Electron energy states in liquid metals

A molecular orbital model of melting and glass formation ....See Entry 72091

71.25M Electron energy states in amorphous and glassy solids

72293 XPS study of glassy $Pd_{80}Ge_{20}$. R.C.Budhani, A.Banerjee, T.C.Goel, K.L.Chopra (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.93-102 (April 1983).
An X-ray photoemission and Auger electron spectroscopy study of the electronic structure of $Pd_{80}Ge_{20}$ alloy in its glassy and crystalline states is reported. The glassy state shows some modifications in the valence band structure, symmetry of the Pd $3d_{3/2}$-$3d_{5/2}$ spin-orbit doublet and a shift in M_{45}-V-V Auger transition of Pd. Analysis of the chemical shifts in the core-level binding energies of the constituents indicates negligible charge transfer from the metalloid atom (Ge) to d-band of the Pd. (29 refs.)

72294 Semiconductor-like structure of infinite linear polyacene. M.Baldo, G.Piccitto, R.Pucci, P.Tomasello (Dipartimento di Fisica, Univ. di Catania, Catania, Italy).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.201-3 (25 April 1983).
The authors investigate the Hartree-Fock ground state stability of linear polyacenes against spin-wave distortions. It is predicted that linear polyacenes with very many rings have an antiferromagnetic-like ground state and a semiconductor structure with a gap of about 1-2 eV. (19 refs.)

72295 Comments on the theory of amorphous semiconductors. M.H.Cohen (Corporate Res. Labs., Exxon Res. & Engng Co., Linden, NJ, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.125-37
Comments are made on the following: The nature of the intrinsic band tails in pure amorphous silicon, the Lloyd model, the influence of shallow impurity levels on band tails, the effect of disorder on deep levels, the question of whether excitons exist in amorphous semiconductors, the conductivity problem, the mobility edge problem, and optical absorption. New results are presented concerning the Lloyd model, shallow and deep impurity or defect levels, and excitons. In particular, the author concludes that excitons continue to exist as bound states only when the exciton lies below a Lifshitz limit, otherwise they survive only as resonance. (19 refs.)

72296 Electronic structure of Cu-Zr and PdSi metallic glasses. F.A.Leon, K.H.Johnson (Center for Materials Sci. & Engng., MIT, Cambridge, MA, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.193-7
The local electronic structures of representative amorphous alloys have been calculated using the SCF-Xα-SW cluster molecular orbital method. Prototype cluster models have been constructed for Cu-Zr and Pd-Si alloys which exemplify two major classes of binary (A-B) glass-forming systems, namely: (1) metallic glasses based on noble or transition elements (e.g. A=Cu) toward the right of the periodic table and transition elements (e.g. B=Zr) toward the left of the periodic table, (2) metalloid glasses based on transition elements (e.g., A=Pd) toward the middle of the periodic table and nonmetallic elements (e.g. B=Si) toward the right of the periodic table. The calculated electronic structures are in good quantitative agreement with, and provide an interpretation of, published photoelectron spectra for the above amorphous alloys. (12 refs.)

A molecular orbital model of melting and glass formation ....See Entry 72091

The SXES study of the amorphous Ni-P compounds ....See Entry 72893

71.25P Band structure of crystalline metals

72297 Ligand field calculation of the relative displacements of the *d* band in V_3X system. Zhu Yuan-zhen, Pan Shao-hua (Inst. of Phys., Acad. Sinica, Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.411-16 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
By employing the method of ligand field theory, the authors calculated the additional potential energies of *d* electron states of V_3X (X=Si, Ga, Ge, Sb, Sn) superconducting compounds; these energies are induced by the D_{2d} crystal field. They obtained the analytic relation between the lattice constant and the relative displacement of *d* sublevels $\Delta E_\perp$, which is the characteristic quantity for the model of *d* band relative displacement. The numerical values of $\Delta E_\perp$ and the magnetic susceptibilities calculated by using them are also presented. (13 refs.)

72298 Electronic, superconducting, and optical properties of technetium from its augmented-plane-wave band structure. P.Chatterjee (Dept. of General Phys. & X-rays, Indian Association for the Cultivation of Sci., Jadavpur, Calcutta, India).
Phys. Rev. B (USA), vol.27, no.8, p.4722-8 (15 April 1983).
The detailed energy-band structure of hexagonal-close-packed technetium, corresponding to the atomic configuration $4d^55s^2$ of its seven outermost valence electrons, has been obtained throughout the Brillouin zone using the composite-wave variational version of the augmented-plane-wave (APW) method in conjunction with the $X\alpha$ (α=0.702 99) exchange approximation for obtaining the potentials. From the band-structure data the electronic density of states (DOS) and the angular-momentum-decomposed DOS were calculated by the accurate Gilat-Raubenheimer method (1967). These quantities were used to calculate the electron-phonon coupling constant and the transition temperature (T_c) using the theories of Gaspari and Gyorffy (1972) and of Mcmillan (1968). Also studied were the Fermi surface and the optical properties of Tc via the imaginary part of the interband dielectric constant for bound electrons, the latter being the first of such study on Tc to date. The superconducting properties and the Fermi surface which could be compared to experiments show, in general, satisfactory agreement. (32 refs.)

72299 Exchange banding of excited core states and its effects on core-level spectroscopies. H.S.Gotts (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA), A.J.Glick.
Phys. Rev. B (USA), vol.27, no.8, p.4729-42 (15 April 1983).
The core levels of interest for soft-X-ray spectroscopies of the light metals are low-lying states with little overlap between states on neighboring ions. Consequently, it is usually assumed that the core level is very narrow and whatever width it has is due to lifetime and phonon broadening. However, when an electron is removed from a core state in a metal, a net transport mechanism appears other than direct tunnelling between sites. First-order exchange can carry a conduction electron into the core hole while an electron from another core site refills the conduction state. The net effect is the movement of the hole. This mechanism provides a first-order coupling between sites and results in the formation of an excited core-hole band. The authors discuss the spatial dependence and magnitude of the coupling between sites, the resulting band structure of the core level, and the implications of the banding on inner-shell spectra and their interpretation, particularly for the metals lithium and sodium. The calculated bandwidths range from ~8 to 25 meV for *K* levels and ~0.1 to 0.2 meV for the *L* levels (Na). Although the bandwidth (Li) is found to be of the same order of magnitude as the lifetime broadening, it affects the spectra in a very different way. Excited core states are now associated with a definite crystal momentum, and momentum is conserved in the transitions giving rise to the spectra. This selection rule serves to reduce the effect of the bandwidth on the (soft-) X-ray edge shapes. The bandwidths for Li and Na are shown to have little effect on the core-level spectra of these metals. (24 refs.)

XPS study of glassy $Pd_{80}Ge_{20}$ ....See Entry 72293

Electron structure of metal surfaces ....See Entry 72459

Calculation of λ for the quasi-one-dimensional superconductor V_3Si ....See Entry 72541

Electromagnetic excitations in noble metals ....See Entry 72674

Thermoreflectance test of W, Mo, and paramagnetic Cr band structures ....See Entry 72777

Excitonic effects in the interband spectra of metals ....See Entry 72829

Structural and electronic properties of Fe and TiFe from extended and near-edge X-ray-absorption structure ....See Entry 72887

X-ray spectra and electronic structure of titanium, zirconium and hafnium gallides ....See Entry 72888

Changes in AlMgSi surface layers at different temperatures ...See Entry 72892

Scattering of slow electrons by a surface and its relationship to the energy structure ....See Entry 72904

Observation of spin-split electronic states in solids by energy-, angle-, and spin-resolved photoemission ....See Entry 72948

Calculation of spin-polarized threshold photoemission from the Ni(001), Ni(111), and Ni(110) surfaces ....See Entry 72954

Lineshape studies of the X-ray photoemission of small metal clusters ....See Entry 72962

71.25R Band structure of crystalline elemental semiconductors

72300 Bandwidth narrowing in n-type many-valley semiconductors. M.Fabbri, A.Ferreira da Silva (Inst. de Pesquisas Espaciais, Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Sao Jose dos Campos, Brazil).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.103-12 (April 1983).
A simple method that takes into account the many-valley effects of the host conduction band is outlined for the calculation of the impurity density of states. *N* random impurity sites were simulated with a computer, within a diamond lattice as a host. A Kohn-Luttinger donor wave function was associated with each impurity. It was found that the low energy side (or the high energy side when the effect of non-orthogonality is taken into account) of the density of states is strongly reduced to a small tail when compared to the case of neglecting many-valley effects. At the Fermi energy, the density of states is considerably enhanced which leads to an enhancement of the extrinsic specific heat. The inverse participation ratio varies with the impurity concentration, presenting different states which are responsible for different physical properties. An analytical calculation taking into account these effects was carried out for the sake of comparison. (14 refs.)

72301 The deformation potentials $\Xi\$_u^X$, Ξd^X of the X-valleys of the germanium conduction band. V.N.Ermakov, V.V.Kolomets, V.S.Timoshuk (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K77-8 (1 April 1983).
The authors show that using the results of Arisumi et al. (1969) where the value $\Xi_d^X+{}^1/_3\Xi_u^X$ was determined from I-U characteristics of a reverse-biased germanium tunnel diode at $\vec{P}\parallel[111]$ and the results of the authors paper (1979) on n-Ge piezoresistance at $\vec{P}\parallel[100]$ one may separately determine the values of the deformation potential constants. (4 refs.)

72302 Temperature dependence of the direct gap of Si and Ge. P.B.Allen (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA), M.Cardona.
Phys. Rev. B (USA), vol.27, no.8, p.4760-9 (15 April 1983).
The temperature dependences of the lowest direct gaps of germanium and silicon are calculated. They result from the effect of electron-phonon interaction on the corresponding electronic states. Both Debye-Waller (second-order interaction Hamiltonian) and 'self-energy' (first-order interaction Hamiltonian) are included. It is shown that the latter are by no means negligible. They reduce the calculated temperature coefficients at constant volume by a factor of 1.7 in the case of Si and 1.3 in the case of Ge. Agreement with experimental data is satisfactory. (22 refs.)

The non-parabolicity of the n-Si conduction band caused by elastic deformation along the [111] direction ....See Entry 72396

Scattering of slow electrons by a surface and its relationship to the energy structure ....See Entry 72904

71.25T Band structure of crystalline semiconductor compounds and insulators

72303 On the conduction band edge energy of ice. D.Grand, A.Bernas (Phys. Chimie des Rayonnements, Univ. Paris-Sud, Orsay, France).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.119-22 (6 May 1983).
The conduction band edge energy V_0 of polycrystalline ice relative to vacuum has been estimated from the optical ionization potential I_{sol} of an impurity molecule A. Recording the stimulated recombination luminesence for A=indole leads to I_{sol}=5.55 eV and V_0=−0.1 eV, which is consistent with corresponding liquid-phase values. (21 refs.)

72304 Electronic structure of antiferromagnetic MnTe. M.Podgorny, J.Oleszkiewicz (Lab. Nazionali di Frascati, Istituto Nazionale Fisica Nucleare, Frascati, Italy).
J. Phys. C (GB), vol.16, no.13, p.2547-57 (10 May 1983).
The authors present a band calculation for antiferromagnetic MnTe. MnTe is found to be a semiconductor with an indirect energy gap of 0.35 eV. The

density of states and reflectivity spectra are presented and compared with experiment. As a result of comparison they conclude that optical properties of MnTe can be described in the framework of band theory. (35 refs.)

72305 Unusual behavior of Hg$_{1-x}$Cd$_x$Te and its explanation. W.E.Spicer, J.A.Silberman, P.Morgen, I.Lindau (Stanford Univ., Stanford, CA, USA), J.A.Wilson, An-Ban Chen, A.Sher.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.60-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors study the unusual semiconductor alloy, Hg$_{1-x}$Cd$_x$Te. They report the virtual crystal approximation (VCA) in that alloy (the first such breakdown in a semiconductor alloy), the success of the coherent potential approximation (CPA), the 'first order' explanation of these results in terms of energies of atomic valence levels, and the qualitative explanation of the unusual properties of Hg$_{1-x}$Cd$_x$Te in terms of the results reported above. Measurements were made with the use of photoemission spectroscopy. Cd and Hg core shifts are detected as a function of alloy composition and related to bonding concepts developed here. (12 refs.)

72306 Cyclotron resonance study of the conduction band in GaP. N.Miura, G.Kido, M.Suekane, S.Chikazumi (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.66-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Far-infrared cyclotron resonance was observed in n-type GaP at high magnetic fields in the megagauss range. For magnetic fields parallel to the ⟨100⟩ axis, the second absorption peak was observed at 100 T in addition to the first peak at 23T for a wavelength of 119 μm. The apparent cyclotron masses of electrons were thus determined to be $m^*_t=0.254\pm0.004$ m_0 and $m^*_l=4.8\pm0.5$ m_0 at 119 μm. At 337 μm, on the other band, a broad absorption band was observed around 42 T besides the first peak at 8.0 T. (10 refs.)

72307 Bonding nature of conduction states in electron-deficient semiconductors: Mg$_2$Si. F.Meloni (Istituto di Fisica, Univ. di Cagliari, Cagliari, Italy), E.Mooser, A.Baldereschi.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.72-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electronic properties of Mg$_2$Si are calculated with the self-consistent pseudopotential method. The resulting energy bands agree with those of previous empirical pseudopotential calculations, are consistent with interband optical data, but are at variance with photoemission measurements since they predict the existence of a 3.5 eV intervalence energy gap. Analysis of the electronic charge distribution shows that the material is ionic with weak Mg-Si bonds. The first four conduction bands are formed from bonding molecular orbitals which extend throughout the unit cell. This surprising feature, probably common to other electron deficient semiconductors, is correlated to the low value of the energy gap in Mg$_2$Si, Mg$_2$Ge and Mg$_2$Sn. (17 refs.)

72308 'Two-hump' structure and parameters of the *X* minimum of the conduction band of cubic III-V semiconductors. A.A.Kopylov (V.I. Ulyanov Inst. of Electrical Engng., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1380-3 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2141-5 (Dec. 1982). [received: May 1983]
A theoretical determination is made of the parameters of the *X* minimum of the conduction band of cubic III-V semiconductors. It is shown that all III-V compounds, with the exception of AlP and InP, should have a two-hump structure of the X_1^c minimum, similar to that exhibited by GaP. A calculation is made of the temperature dependence of the density-of-states effective mass in the conduction band, which is due to the complex structure of the X_1^c minimum. (12 refs.)

Magnetic properties of the compound HfFe$_2$Si$_2$ ....See Entry 72633

Optical absorption in single-crystal metastable (GaAs)$_{1-x}$(Ge$_2$)$_x$ alloys; evidence for a zinc-blende-diamond order-disorder transition ....See Entry 72752

Reflectance and UPS studies of band structures and final state interactions of low-spin pyrites ....See Entry 72830

Scattering of slow electrons by a surface and its relationship to the energy structure ....See Entry 72904

Energy-band structure of copper iodide [photoelectron spectra] ....See Entry 72939

A study of the valence band structure of Ga$_{0.47}$In$_{0.53}$As by angle resolved photoemission ....See Entry 72950

Study of III-V semiconductor band structure by synchrotron photoemission ....See Entry 72951

Angle-resolved photoemission studies of GaAs(100) surfaces grown by molecular-beam epitaxy ....See Entry 72955

X-ray photoelectron spectra of the spinel systems CdCr$_x$In$_{2-x}$S$_4$ and ZnCr$_x$Al$_{2-x}$S$_4$ ....See Entry 72956

Angle-resolved photoemission studies of the CdS band structure ....See Entry 72965

71.30 METAL-INSULATOR TRANSITIONS

72309 Correlations and the metal-insulator transition. L.M.Sander (Phys. Dept., Univ. of Michigan, Ann Arbor, MI, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.115-24
Studies the model of Mott for a correlation-driven metal-insulator transition with particular emphasis on donors in semiconductors. The author considers donors with variable lattice spacing and finds the ground state energy, the magnetic properties, and the band structure. Modern techniques, notably the density-functional method, have led to detailed solutions. The author reproduces the Mott criterion ($n^{1/3}a_0=0.25$) for the metal-insulator transition which occurs at band crossing. His results agree with experiments for a wide variety of systems. The relationship to the Hubbard model is discussed. The results are useful even in a disordered system for predicting properties which are not sensitive to randomness, such as average band gap and dielectric enhancement. (22 refs.)

Phase transitions in electron-hole liquids ....See Entry 72315

Localization redux ....See Entry 72340

Localization and correlation effects in metals and semiconductors—experiment ....See Entry 72341

Experimental tests of localization in semiconductors ....See Entry 72357

Critical behavior of the low-field Hall conductivity at a percolation threshold ....See Entry 72368

Conduction of two-dimensional systems with dielectric inclusions ....See Entry 72470

Phase diagram and critical temperatures of nearly half-filled quasi one-dimensional conductors ....See Entry 72532

71.35 EXCITONS AND RELATED PHENOMENA

(inc. electron-hole drops)

72310 The vibration-quenching of the exciton and the Huang-Rhys factor in the quasi one-dimensional antiferromagnet CMC. Jia Wei-yi (Inst. of Phys., Acad. Sinica, Beijing, China), W.M.Yen.
Acta Phys. Sin. (China), vol.32, no.3, p.346-53 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The exciton transition $^4T_1\rightarrow{}^6A_1$ of Mn$_n^{2+}$ ions in quasi one-dimensional antiferromagnet CsMnCl$_3$.2H$_2$O is very weak in intensity with a shorter lifetime due to the vibration-quenching. Replacing H$_2$O by D$_2$O, three important effects have been observed: the exciton line is shifted to the red by 18 cm^{-1}, the intensity of the exciton is increased by almost one order, the lifetime is lengthened from 0.58 ms to 9.2 ms. These facts show that the vibration-quenching has been weakened. The experimental results are analysed by means of the theory of multi-phonon radiative and non-radiative transitions. It has been shown that the isotope substitution changes the spectrum of lattice vibration, and brings forth a great influence on the non-radiative transition. The electron-phonon coupling intensity does not show any obvious change, and the Huang-Rhys factor remains constant. The phonon modes involved in the multi-phonon radiative transition are different from those involved in the multi-phonon nonradiative process, their average energies are quite different from each other. (12 refs.)

72311 Production of pairs of singlet excitons and triplet excitons in anthracene crystals. G.Klein (Lab. de Phys. des Rayonnements et d'Electronique Nucleaire, CRN, Strasbourg, France).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.114-18 (6 May 1983).
In anthracene crystals excited by high-energy photons (10-50 eV) there is enough to yield pairs of triplet excitons and singles excitons. The efficiencies of these processes are measured as a function of the incident photon energy. (16 refs.)

72312 The broadening of the kinematical exciton levels. G.S.Davidovic-Ristovski, L.M.Ristovski (Inst. of Phys., Faculty of Sci., Belgrade, Yugoslavia), B.S.Tosic, D.Mirjanic.
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.173-5 (25 April 1983).
The anomalous broadening of the exciton levels in a molecular crystal is explained as the broadening of the kinematical exciton levels, which are energetically close to the normal exciton levels. (7 refs.)

72313 Spin-lattice relaxation theory of excited triplet-state impurities in molecular crystals. V.I.Sugakov, Yu.D.Shtepa (Inst. for Nuclear Res., Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi b (Germany), vol.116, no.2, p.633-8 (1 April 1983).
The processes of spin-lattice relaxation of the excited local triplet states in molecular crystals at low temperatures are investigated. The coupling of the translational and rotational motion of the molecule (TRC relaxation mechanism) is chosen as the major phenomenon, leading to the coupling of the spin system with acoustic vibrations. The general expressions for the spin-lattice relaxation time of the triplet centre in molecular crystal with impurities are derived taking into account the change of force constant due to the impurities. The angular, field, and temperature dependences of SLR time are calculated for an isotopic impurity in naphthalene crystal. The results of calculation are in accordance with available experimental data. (17 refs.)

72314 Effect of the pumping intensity on the resonant secondary emission spectra of optically aligned hot excitons in ZnTe crystals. M.Ya.Valakh, A.P.Litvinchuk, G.G.Tarasov (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K61-5 (1 April 1983).
The band-to-band excitation of semiconductors by polarized laser radiation produces polarized secondary emission and its polarization provides information on the energy relaxation of optically aligned hot carriers or excitons. Investigations of the degree of polarization versus the excitation frequency and the number of LO-phonons emitted during the relaxation process have been carried out previously in order to study possible relaxation mechanisms. The authors show that investigations of the effect of excitation intensity on the secondary emission spectra give an important additional information. (6 refs.)

72315 Phase transitions in electron-hole liquids. P.Nozieres (Inst. Laue-Langevin, Grenoble, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.16-22 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The equilibrium thermodynamics of electron-hole gases in semiconductors are reviewed, especially the problems of metal-insulator transitions and Bose Einstein condensations. (28 refs.)

72316 Symmetry breaking excitonic instabilities in deformable lattice. Y.Toyozawa (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.23-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Three types of symmetry-breaking instabilities of exciton(s) in the phonon field are described on a unified view-point and in comparison with relevant observations. (i) Self-trapping—broken translational symmetry—takes place when the exciton-lattice relaxation energy exceeds the exciton kinetic energy for localization. (ii) Decomposition into a pair of self-trapped particles—broken parity—may arise when the electron and the hole have deformation potentials of opposite sign. (iii) If the total lattice relaxation energy exceeds the Franck-Condon exciton energy, the relaxed electron-hole pairs spontaneously created everywhere will condense into a new ordered state—bulk phase change. (40 refs.)

72317 Symmetry-breaking effect on N-bound excitons in GaP. J.Camassel, H.Mathieu (Centre d'Etudes d'Electronique des Solides, Univ. Sci. et Technol. du Languedoc, Montpellier, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.96-101 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A review of experimental data obtained on N-bound excitons under application of a uniaxial stress is given. This includes: single excitons bound to single nitrogen atoms, excitonic molecules bound to single nitrogen atoms and, lastly, single excitons bound to pairs of nitrogen atoms. (16 refs.)

72318 Shallow isoelectronic excitons revisited. C.Benoit a la Guillaume (Univ. de Paris VII, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.105-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A simple model of isoelectronic exciton is solved in the Hartree selfconsistent method. It shows how the usual Hopfield, Thomas, Lynch model is modified for very small binding. It explains well the excitation spectrum of excitons bound to NN pairs in GaP. A new calculation of the energy of NN_i^- is presented, which proves unambiguously that the N^- state in GaP is unstable. (7 refs.)

72319 Excitation spectroscopy in silicon: pseudo-acceptor excited states of the isoelectronic A, B, C exciton system. J.Wagner (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), R.Sauer.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.113-15 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors perform excitation spectroscopy with a tunable $NaF:(F_2^+)^*$ color center laser on the isoelectronic A, B, C exciton system in silicon and detect seven highly excited states. They are interpreted in terms of excited hole states of a pseudo-acceptor split in the axially symmetric field of the binding center. The hole states fit excellently into the systematics of common acceptor spectra in silicon when the pseudo-acceptor ionization energy is chosen as 36.7 meV. (11 refs.)

72320 Theoretical and experimental aspects of the nonlinear spectroscopy of biexcitons in CuCl. I.Abram, A.Maruani, D.S.Chemla, F.Bonnouvrier, E.Batifol (CNET, Bagneux, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.301-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Forward degenerate fourwave mixing in CuCl in the vicinity of the two-photon absorption on the biexciton can be analyzed from two complementary theoretical points of view: (a) In terms of the traditional perturbational formulation of nonlinear optics, the low intensity observations can be accounted for in terms of interferences and re-normalizations among different-order elementary mixing processes; (b) In terms of a perturbational scheme which provides directly an analytic expression for the intensity-dependent dielectric function of the material. This last approach points to a potentially bistable optical response when local field effects are included in the calculation. (6 refs.)

72321 Non-equilibrium exciton phase in the high density regime of a direct-gap semiconductor. G.W.Fehrenbach, W.Schafer, J.Treusch, R.G.Ulbrich (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.303-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The 1s-exciton absorption of GaAs is measured under conditions of fast transient resonant excitation with laser pulses of 8 psec duration and 1.2 meV bandwidth centered on the 1s-exciton line. The 1s-exciton remains stable up to pair densities exceeding the Mott density by more than an order of magnitude. This remarkable persistence is due to the resonant excitation mechanism: the existence of a gap between the externally excited 1s exciton state and free electron-hole pair states leads to a strong reduction of screening in comparison with plasma screening through mobile carriers. (6 refs.)

72322 Electron-hole liquid condensation: systematics and scaling relations. T.L.Reinecke (Naval Res. Lab., Washington, DC, USA), A.Forchel, H.Schweizer, B.Laurich, A.Hangleiter, J.Wagner, W.Schmid.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.315-17 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Studies of electron-hole liquid (EHL) condensation in Si, in several strained Si systems, in strained Ge, and in GaP are reported, and they provide the most extensive results to date for the systematic variations with band structure of the ground state and critical properties of EHL. The ground state densities of these systems vary by a factor $\sim 10^3$ and the critical temperatures by a factor ~2O. Investigations of Si with varying magnitudes of uniaxial strains provide the first systematic data for systems with significant band non-parabolicities. Based on these results proposals for scaling relations between the ground state properties and the critical points are tested, and a recently proposed set is verified in quantitative detail. (9 refs.)

72323 Interaction of phonons with the electron-hole liquid. J.P.Wolfe (Phys. Dept., Univ. of Illinois, Urbana, IL, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.321-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Three new experiments are described which quantify the interaction of high-frequency phonons with the electron-hole liquid. Drift measurements in Si have determined the mobility of electron-hole droplets (EHD) and shown a temperature dependence of the electron-phonon scattering rate which is characteristic of a degenerate Fermi fluid. The drift velocity of EHD strongly saturates at near-sonic velocities, suggesting a Cherenkov-like phonon emission. Phonon spectroscopy in the 150-500 GHz range has determined the dynamic deformation potential and demonstrated the predicted $2k_F$-cutoff in the absorption of phonons by EHD in Ge. Time-resolved luminescence imaging has revealed an interesting phonon-wind-induced anisotropy in a cloud of electron-hole droplets which is produced by intense pulsed-laser excitation of Ge. (22 refs.)

72324 Spin aligned exciton gas in uniaxially compressed Ge. V.B.Timofeev, V.D.Kulakovskii, I.V.Kukushkin (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.327-32 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Demonstrates a unique opportunity for investigation of the statistical behaviour of a spin aligned exciton gas up to high densities corresponding to $r_s \approx 2$ at $T \approx 2K$ in strongly uniaxially compressed Ge in a magnetic field. The experimentally observed changes in the exciton-phonon emission spectra of a dense exciton gas are interpreted in terms of the weakly nonideal Bose-gas. The ionization collapse (Mott transition) of excitons giving rise to an abrupt change in electron transport phenomena has been observed at density corresponding to $r_s = 2$. (21 refs.)

72325 Theoretical and experimental studies of the transition from the exciton to the plasma phase. S.Schmitt-Rink (Inst. fur Theoretische Phys., Univ. Frankfurt, Frankfurt, Germany), J.P.Lowenau, H.Haug, K.Bohnert, A.Kreissl, K.Kempf, C.Klingshirn.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.339-41 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The complex dielectric function of a semiconductor is calculated for an arbitrary number of free carriers. Large dispersive changes occur when the exciton is ionized due to an increased screening of the Coulomb potential. The intensity-dependent changes of the refraction and absorption spectra are measured directly from the shifts to the eigenmodes of a CdS platelet resonator. (5 refs.)

72326 Eigenstates of *N* excitons and one hole. R.Schilling, D.C.Mattis (Phys. Dept., Univ. of Utah, Salt Lake City, UT, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4661-4 (15 April 1983).
The authors solve for the eigenstates and energy eigenvalues of N immobile Frenkel excitons (a relatively trivial proposition) and of N such excitons plus one hole (which for large N can only be done in one dimension). They also guess that a charged globule, consisting of N excitons and $O(N)$ holes, can be stable, if, in any number of dimensions, m_h^* for holes is much larger than m_e^* for electrons. (8 refs.)

72327 The Brewster effect in exciton reflectance spectra. A.B.Pevtsov, A.V.Sel'kin (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.282-90 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.516-31 (Aug. 1982). [received: May 1983]
The conditions under which the Brewster effect manifests itself in exciton oblique-reflectance spectra are considered for the first time. It is shown that, in the isolated-exciton-resonance model that takes account of the spatial dispersion and the presence on the crystal surface of an exciton-free homogeneous dielectric layer, the reflectance can vanish completely for either the *p*-or *s*-polarized component within the limits of the exciton reflectance band. The amplitude-phase spectral dependence of the reflectance has been experimentally investigated for the crystals ZnTe, ZnP_2 ($T=2K$), and CdS ($T=2$ and 77K) in the case of oblique incidence of the light in the region of the lowest exciton resonances. The results show that the exciton Brewster effect occurs in all these crystals (in the case of ZnP_2 it manifests itself in the *s*-polarized component). The theoretical model satisfactorily describes the experimental data. (23 refs.)

72328 Low-energy surface exciton impurity states. V.N.Ermakov, O.Yu.Mikityuk, V.V.Nitsovich.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.534-7 (April 1983). In Russian.
Localization of surface excitons on impurities with small effective charges is investigated. An equation of state is derived in the T-matrix approximation for the surface impurity-bound exciton. An oscillator force is calculated for the exciton transition to localized surface exciton-impurity states with low binding energy. (7 refs.)

Proceedings of the 16th International Conference on the Physics of Semiconductors .... See Entry 69780

Theory of electronic structures and lattice distortions in polyacetylene and itinerant Peierls systems. III. Coulomb effects on solitons and effective Coulomb potential in trans-polyacetylene .... See Entry 72289

Comments on the theory of amorphous semiconductors .... See Entry 72295

Determination of additional boundary conditions in CuCl [excitonic polaritons] .... See Entry 72329

Thermodynamic properties of equilibrium and non-equilibrium plasmas in GaP .... See Entry 72434

Widths of magnetic exciton lines exhibited by cubic Laves phases $PrAl_2$ and $PrNi_2$ .... See Entry 72595

Giant spin splitting of exciton states and optically detected magnetic resonance in A^2B^6 crystals containing magnetic impurities .... See Entry 72715

The 'missing' electromagnetic wave and the additional boundary conditions for light in a crystal .... See Entry 72756

Nonlinear photoelasticity of crystals in the exciton resonance region .... See Entry 72767

Electroabsorption by Stark effect on room-temperature excitons in GaAs/GaAlAs multiple quantum well structures .... See Entry 72769

Local induced activity in resonant Raman scattering of GaP:N .... See Entry 72804

Momentum resolved polariton spectroscopy in CuBr in the presence of magnetic field .... See Entry 72805

Phonon selectivity in resonant Brillouin scattering (RBS) from multi-component polaritons .... See Entry 72824

Resonant Brillouin scattering in GaAs—linewidth measurements and the effect of stress .... See Entry 72825

Excitonic effects in the interband spectra of metals .... See Entry 72829

Optical determination of exciton sizes in semiconductors .... See Entry 72831

Steady-state delayed fluorescence signals in Ronchi ruling experiments: theory of coherence effects .... See Entry 72847

Low temperature photoluminescence of lightly Si-doped and undoped MBE GaAs .... See Entry 72852

Disorder and N-N transfer mechanism in nitrogen-bound exciton luminescence of GaP_xAs_{1-x}:N systems .... See Entry 72861

Momentum-space condensation of probe-injected biexcitons into a strongly pumped biexciton state in CuCl .... See Entry 72862

The role of iodine for the luminescence of highly excited AgBr .... See Entry 72863

71.36 POLARITONS

(inc. photon-phonon and photon-magnon interactions)

72329 Determination of additional boundary conditions in CuCl [excitonic polaritons]. Y.Segawa, Y.Aoyagi, S.Komuro, S.Namba (Inst. of Phys. & Chem. Res., Saitama, Japan), S.Inoue, M.Nakayama.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.309-11 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Two induced absorption lines from the upper and the lower branch excitonic polaritons to the excitonic molecule were observed in CuCl near the longitudinal exciton. The intensity of the induced absorption from the lower branch polariton decreases gradually with the increase of the energy at the high energy side of the longitudinal exciton. The oblique incidence reflection spec-

tra were also observed for the same sample. A sharp structure appears in the p wave reflection spectrum. A new theory of additional boundary conditions by a model for the surface scattering of the polariton can fairly well explain the observed results. (5 refs.)

The investigation of zinc oxide film photodestruction by means of surface polariton spectroscopy and X-ray diffraction analysis ....See Entry 72277

Cyclotron resonance of a polaron ....See Entry 72675

Momentum resolved polariton spectroscopy in CuBr in the presence of magnetic field ....See Entry 72805

Phonon selectivity in resonant Brillouin scattering (RBS) from multi-component polaritons ....See Entry 72824

Resonant Brillouin scattering in GaAs—linewidth measurements and the effect of stress ....See Entry 72825

Elementary surface excitations in insulators and metals. Methods of spectral examination ....See Entry 72878

71.38 POLARONS AND ELECTRON-PHONON INTERACTIONS

(for electron-phonon interactions in lattices, see also 63.20K)

72330 The bound one-dimensional ‘relativistic’ polaron in a one-loop approximation. A.A.Bytsenko, S.A.Ktitorov (A.F. Ioffe Phys.-Tech. Inst., Acad. of Sci, Leningrad, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.316-18 (9 May 1983).
A quasirelativistic model of the narrow-gap semiconductor is considered. The interaction of the Dirac electron field with the nondispersive phonon field in the short-range external potential (impurity) is taken into account. The classical solutions corresponding to the discrete spectrum are found. The fermion vacuum polarization effect is studied within the one-loop approximation. (7 refs.)

72331 AsF$_5$-doped polyparaphenylene: evidence for polaron and bipolaron formation. G.Crecelius, M.Stamm (Inst. fur Festkorperforschung der Kernforschungsanlage, Julich, Germany), J.Fink, J.J.Ritsko.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1498-1500 (9 May 1983).
Both elastic and inelastic electron scattering have been used to characterize and investigate the electronic properties of AsF$_5$-doped polyparaphenylene. Evidence is presented for the existence of a polaron state slightly above the top of the valence band at low doping levels. An increase in the doping level first leads to the formation of bipolaron states which broaden and finally form a band in the gap in agreement with recent theoretical predictions. (7 refs.)

72332 Many electron magnetic polaron in magnetic semiconductors. J.Sinkkonen, P.Kuivalainen (Dept. of Electrical Engng., Helsinki Univ. of Technol., Espoo, Finland).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K73-6 (1 April 1983).
The authors study the few electron polaron within a simple potential well model. They take into account the positive background of the crystal, i.e. the space charge layer formed by ionized donors which surround the autolocalized cluster of conduction electrons. This effect, which was neglected by Kasuya (1976), allows them to study, e.g. the molecular magnetic polaron (MMP) stability as a function of doping concentration. (7 refs.)

72333 Direct path-integral treatment of the polaron problem. A.L.Kholodenko, K.F.Freed (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4586-600 (15 April 1983).
Direct evaluation of Feynman's functional integral for the polaron maps it into a standard type of many-body theory. The perturbation expansion is shown to be well controlled and does not require any renormalization. This perturbation expansion has the pleasing feature that nth-order terms in the polaron coupling constant are obtained from nth-order perturbation theory, whereas the traditional perturbation formulation in terms of creation and annihilation operators requires a 2nth-order perturbation calculation to generate the same results. In contrast to previous beliefs, the method is shown to enable the calculation of the polaron effective mass and relaxation time directly from the functional-integral expression. The ground-state energy is computed to second order in the polaron coupling constant to illustrate the use of the method and to establish agreement with previous perturbation treatments. In addition, the authors provide the first perturbation calculation of the polaron effective mass through second order in the coupling constant. Pade approximants are shown to provide a vehicle for analytically extending the perturbation results into the region of intermediate and strong couplings, and the procedure yields reasonable agreement with variational calculations for values of the polaron coupling constant up to about $\alpha=10$. In addition, conditions are derived under which the original polaron action, used in the functional integral, reduces to some of the best variational trial actions utilized in the literature. (37 refs.)

72334 The effect of anharmonism and dispersion on Davydov soliton properties. N.I.Kislukha, A.V.Karbovskii.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.515-20 (April 1983). In Russian.
Properties of the Davydov soliton at velocities close to the limiting velocity of longitudinal sound waves are considered with effect of anharmonism and the mutual effect of anharmonism and the dispersion of sound waves in a molecular chain. For solitons whose energy is lower than the excitation band bottom and which satisfy the applicability condition of the continual approximation, the anharmonism effect appears to dominate and the presence of sound dispersion is reduced. (3 refs.)

Theory of electronic structures and lattice distortions in polyacetylene and itinerant Peierls systems. III. Coulomb effects on solitons and effective Coulomb potential in trans-polyacetylene ....See Entry 72289

Electronic, superconducting, and optical properties of technetium from its augmented-plane-wave band structure ....See Entry 72298

Temperature dependence of the direct gap of Si and Ge ....See Entry 72302

Connection between the heat capacity and the effective mass of the electrons in Fermi-liquid theory at finite temperatures ....See Entry 72336

A tight-binding model of the oxygen-vacancy in SrTiO$_3$ ....See Entry 72342

Strong electron-phonon interaction effects in modulated transient reflectance spectra of Ga$_{.50}$In$_{.50}$P ....See Entry 72832

71.45 COLLECTIVE EFFECTS

72335 Anomalous quantum Hall effect: an incompressible quantum fluid with fractionally charged excitations. R.B.Laughlin (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1395-8 (2 May 1983).
Presents variational ground-state and excited-state wave functions which describe the condensation of a two-dimensional electron gas into a new state of matter. (8 refs.)

72336 Connection between the heat capacity and the effective mass of the electrons in Fermi-liquid theory at finite temperatures. G.O.Zaiitsev (Moscow State Extension Pedagogical Inst., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.331-3 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.601-6 (Aug. 1982). [received: May 1983]
The effect of electron-phonon interaction on the connection between the electronic heat capacity and the effective mass of the electrons in metals is investigated. It is shown that this connection is essentially nonlocal and is independent of the phonon spectrum $g(\omega)=\alpha^2(\omega)F(\omega)$. A simple differential relation is obtained between the heat capacity of the electrons in a metal and the known Fermi-liquid formula for the heat capacity of electrons. (6 refs.)

Ultrahigh-resolution electron microscopy of charge-density waves in 2H-TaSe$_2$ below 100K ....See Entry 72130

Theory of electronic structures and lattice distortions in polyacetylene and itinerant Peierls systems. III. Coulomb effects on solitons and effective Coulomb potential in trans-polyacetylene ....See Entry 72289

Threshold behavior of charge-density waves pinned by impurities ....See Entry 72378

Giant quantum oscillations of sound absorption in a superlattice ....See Entry 72455

Two-dimensional electrons in a magnetic field. III. Many-body effects ....See Entry 72463

71.45G Exchange, correlation, dielectric and magnetic functions, plasmons

72337 The total dielectric screening effect in III-V and II-VI compounds. M.Grinberg (Dept. of Phys., Warsaw Tech. Univ., Plock, Poland), S.Legowski, H.Meczynska.
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.485-95 (April 1983).
The total spatial dielectric functions and the wave-vector-dependent dielectric functions for III-V and II-VI compound semiconductors CdTe, GaAs are obtained for a model which includes the anharmonicity of the lattice. It has been pointed out that the ionization donor energies are slightly affected by the anharmonicity. Therefore in the investigated compounds the scaling procedure of the electronic dielectric function is justified. (21 refs.)

72338 Amplification of two-dimensional plasma waves by a charged-particle beam. N.N.Beletskii, S.N.Khar'kovskii, V.M.Yakovenko (Sci.-Res. Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1409-10 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2182-5 (Dec. 1982). [received: May 1983]
The authors describe a method of generating surface plasmons in a two-dimensional electron gas by a steam of charged particles incident normally on its surface. Then, in contrast to the case of parallel motion, the relationship between the velocity of a beam and the phase velocity of waves can be arbitrary. Moreover, the thickness of a two-dimensional layer is then so small that the layer is in fact transparent to a charged-particle beam. (7 refs.)

Theoretical and experimental studies of the transition from the exciton to the plasma phase ....See Entry 72325

Structure and magnetism in a hydroxy bridged binuclear copper(II) system with a ‘tunable’ binuclear centre ....See Entry 72364

Drag of electrons by a longitudinal electric wave and sign of the drag force ....See Entry 72419

Plasmon excitation in Al-Mg surfaces ....See Entry 72467

Reflectance spectra and dielectric functions for Ag in the region of interband transitions ....See Entry 72833

Angular scan spectrum of a surface plasma excitation on a Schottky diode ....See Entry 72880

The elastic peak in AES and EELS ....See Entry 72898

Parallel-processing with surface plasmons, a new strategy for converting the broad solar spectrum ....See Entry 73450

71.45N Calculations of total electronic binding energy

(see also 61.50L Crystal binding)

72339 Diatomic molecules and metallic adhesion, cohesion, and chemisorption: a single binding-energy relation. J.Ferrante (NASA, Lewis Res. Center, Cleveland, OH, USA), J.R.Smith, J.H.Rose.
Phys. Rev. Lett. (USA), vol.50, no.18, p.1385-6 (2 May 1983).
It has been discovered that a single relation between binding energy and interatomic spacing can describe the energetics of diatomic molecules, bulk metals, bimetallic interfaces, and gas atom-metal surface interactions. (7 refs.)

71.50 LOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

(exc. impurities; for localisation in disordered structures, see 71.55J)

72340 Localization redux. P.W.Anderson (Bell Labs., Murray Hill, NJ, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.30-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The author surveys recent progress in the field of localization. Theory and experiment are in excellent agreement in two-dimensional systems such as inversion layers and thin metal films. The metal insulator transition in three-dimensional systems remains an interesting problem as exemplified by highly accurate data on doped semiconductors, but on the metallic side perturbational theory has had a number of successes. (39 refs.)

72341 Localization and correlation effects in metals and semiconductors—experiment. R.C.Dynes (Bell Labs., Murray Hill, NJ, USA).
Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium, Argonne, IL, USA, 2-3 Nov. 1981 (New York, USA: North-Holland 1982), p.139-52
The current experimental situation with respect to electron localization and the metal-insulator transition is reviewed. Attempts to study the phenomena in one, two and three dimensions are outlined. One dimensional effects have been clearly observed, but at the moment the length scale remains a mystery and it is difficult to separate localization effects from many-body correlations. In two dimensions, magnetoresistance, Hall effect and temperature dependent resistivity measurements allow a measure of the relative strengths of these two effects, and illustrate remaining problems. In three dimensions, various systems studied illustrate strong correlation effects and apparent differences. The nature of the transition remains elusive. (41 refs.)

Melting, Localization, and Chaos. Proceedings of the Ninth Midwest Solid State Theory Symposium .... See Entry 69788

Electronic states of doped semiconductors: a multiple scattering approach .... See Entry 72291

Optical polarization of nuclear angular momenta in amorphous Si-Dy .... See Entry 72700

***f*-count effects in X-ray-absorption spectra of the 3*d* levels in Ce and its intermetallic compounds** .... See Entry 72886

Lineshape studies of the X-ray photoemission of small metal clusters .... See Entry 72962

71.55 IMPURITY AND DEFECT LEVELS

72342 A tight-binding model of the oxygen-vacancy in $SrTiO_3$. M.O.Selme, P.Pecheur (Lab. de Phys. du Solide, ENSMIM, Nancy, France).
J. Phys. C (GB), vol.16, no.13, p.2559-68 (10 May 1983).
Using a tight-binding parameterisation of the band structure of $SrTiO_3$ together with the Green functions method, the authors calculate the energy levels of the oxygen vacancy. They show the ionic character of this defect and compare their results with previous calculation and experiments. They suggest an instability of the neutral and singly ionised vacancy with respect to polaron formation. (21 refs.)

72343 Electronic states of *F*-type centers in oxide crystals: a new picture. S.-il.Choi (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA), T.Takeuchi.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1474-7 (9 May 1983).
A strong case is made to show that the *F*-type color centers in oxide crystals are qualitatively different from the color centers of alkali halides. A semi-quantitative discussion is followed by the results of an $X\alpha$ self-consistent-field calculation for the α-Al_2O_3 crystal. An oxygen-ion vacancy in α-ilumina is a deep electron trap, the ground state of which lies between the two valence bands, unlike the *F* center of alkali halides whose ground state lies between the valence and conduction bands. The two electrons in the trap are stabilized by a hole. (16 refs.)

72344 Structure of muons trapped in aluminium. B.I.Craig (Dept. of Phys., Univ. of Newcastle, Newcastle, NSW, Australia).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K91-4 (1 April 1983).
The author uses the aluminium-hydrogen system to investigate the trapping of muons in aluminium. A point positive charge $+e$ is assumed to describe the proton. A highly localised wave function for the interstitial has therefore been assumed. The resulting electronic structure is obtained through the calculation of the change in the metal valence electron charge density $\Delta\rho(\bar{r})$. (6 refs.)

72345 Electrical properties of donors in gallium phosphide. B.Podor (Res. Lab. for Inorganic Chem., Hungarian Acad. of Sci., Budapest, Hungary).
Phys. Status Solidi a (Germany), vol.76, no.2, p.695-704 (16 April 1983).
The thermal ionization energies of S, Te, and Si donors in GaP and their dependences on impurity concentration are determined from an analysis of Hall effect data. An ellipsoidal six-valley model is used incorporating the effects of valley-orbit splitting of the ground state of the P-site donors. A careful characterization of the samples ensures that results are obtained on samples containing only one type of dominant donor. The thermal ionization energies of the above donors extrapolated to infinite dilution are (105.0 ± 5.7), (94.1 ± 2.6), and (83.5 ± 1.7) meV, respectively. The valley-orbit splitting energies of S and Te donors are also obtained, amounting to (34 ± 9) and (23.5 ± 9) meV, respectively. (33 refs.)

72346 Deep levels in semiconductors. G.D.Watkins (Dept. of Phys., Lehigh Univ., Bethlehem, PA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.9-15 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The 3d transition element ion impurities in silicon are reviewed for the broad insight they provide in understanding deep levels in semiconductors. As interstitials, their interaction with the host tends to confine the d-levels to the forbidden gap, providing many deep states. The interaction at the substitutional site is best considered as an interaction with the lattice vacancy, into which the impurity is placed. This interaction tends to repel deep a_1 and t_2 levels from the gap. When the levels are present, they are mostly vacancy-like and the defect is likely to display the large lattice relaxations characteristic of the vacancy. (31 refs.)

72347 Far-infrared studies of the bound and free carriers in n-InSb as a function of hydrostatic pressure. Z.Wasilewski (Phys. Dept., Univ. of St. Andrews, St. Andrews, Scotland), A.M.Davidson, R.A.Stradling.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.89-91 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Magneto-optical studies are presented of the interaction between Γ and L-associated donor states. The admixture of L-states permits intervalley coupling by a single TA(L) phonon of energy of 35 cm^{-1}. When metastable states of predominantly X-character are occupied, L-like transitions involving the same donor disappear. (12 refs.)

72348 Metastable donor states in Te-doped $Ga_{1-x}Al_xSb$ compounds. L.Konczewicz, E.Litwin-Staszewska, S.Porowski, A.Iller (High Pressure Res. Center 'Unipress', Polish Acad. of Sci., Warsaw, Poland), R.L.Aulombard, J.L.Robert, A.Joullie.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.92-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
On highly doped (Te) n-type bulk crystals of $Ga_{1-x}Al_xSb$ ($x\leq0.3$) the Hall coefficient and resistivity have been measured as a function of temperature in the range 77K-300K and pressure up to 1500 MPa. It was found that the pressure induced strong decrease of L-minimum conductivity is connected with deionization of Te-donor impurity. It is characterized by two states E_d and E_s with different pressure coefficients: $dE_d/dp=4.9\ 10^{-5}$ eV/MPa; $dE_s/dp=1.2\ 10^{-6}$ eV/MPa. The metastable nature of this state was observed and from the analysis of $R_H(t)$ dependences the value of the potential barrier which controls the capture of electrons was determined to be equal to 0.26 eV. At 77K the presistent photoconductivity was observed and optical ionization energy was estimated to be equal 1 eV. (13 refs.)

72349 Electron and positron response to atomic defects in solids: A theoretical study of the monovacancy and divacancy in aluminum. B.Chakraborty, R.W.Siegel (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4535-52 (15 April 1983).
A formalism for self-consistently calculating the response of electrons and positrons to atom defects in solids is presented. The formalism can be used with either the Green's function or supercell method for calculating defect characteristics, and is of general applicability. With the use of this formalism and the self-consistent pseudopotential scheme within a supercell, the electronic structure and positron states and annihilation characteristics associated with the monovacancy and divacancy in aluminum have been studied. The sensitivity of the calculated monovacancy electronic structure and formation energy to the type of ionic pseudopotential used is also examined. Finally, the possibilities for using positron-annihilation spectroscopy to study the electronic structure of vacancylike defects are considered. (35 refs.)

72350 The wave function of impurity states and its pressure dependence. J.Krupski (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland), W.Trzeciakowski.
Solid State Commun. (USA), vol.46, no.4, p.283-6 (April 1983).
The authors calculated the wave function of the ground state of an impurity which introduces into the crystal both Coulomb and short-range potential. The probability of finding an electron at the impurity site and the optical matrix elements for the transitions from the ground state to the excited states were found and their dependence on the hydrostatic pressure was discussed. (5 refs.)

72351 A note on the pressure dependence of the EL2 level in gallium arsenide. P.Dzwig (Cavendish Lab., Cambridge Univ., Cambridge, England).
Solid State Commun. (USA), vol.46, no.4, p.305-7 (April 1983).
Various experiments involving the application of hydrostatic pressure and uniaxial stress to the EL2 level in gallium arsenide are compared with a 4×4 impurity superlattice model. This is used to study the pressure dependence of the unoccupied level and verifies that it does indeed follow the conduction band edge as observed in photocapacitance. It also supports the view that hte separation from the conduction band with pressure of EL2 observed in transient capacitance is due in large part to the pressure dependence of the Franck-Condon shift. It is noted that as compared with $Ga_{1-x}Al_xAs$ in the appropriate range of x, the variation of the level with pressure is approximately correct and that it would seem that the frequently made analogy between alloying and pressure dependence is justified here. (10 refs.)

72352 Energy spectrum of Sn and Ge impurity states in solid solutions based on lead chalcogenides. L.V.Prokof'eva, S.V.Zarubo, M.N.Vinogradova, Yu.A.Nikulin, K.G.Gartsman (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1377-9 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2136-40 (Dec. 1982). [received: May 1983]
The Hall and other transport coefficients were determined in a study of the energy position of the band of *s* states of Sn and Ge in solid solutions based on lead chalcogenides. This position was determined as a function of the solid-solution composition and of temperature. The temperature dependence of the energy impurity states was determined by the role performed by the impurity level in question, interacting with the valence band. At low temperatures *T* an impurity level whose occupancy differed from 0 and 1 was a donor and an increase in *T* shifted the level upward toward the edge of the valence band. At high temperatures *T* an impurity level acted as an acceptor and its temperature-induced shift was in the opposite direction. The nonmonotonic temperature dependences of the energies of the Sn and Ge impurity states were interpreted using a model according to which impurity sites with different charges occupied at low temperatures inequivalent positions in the lattice and, consequently, the occupied and free states of an impurity corresponded to different energies. An increase in *T* reduced the inequivalence of the sites with different charges and at some temperature, which was a function of the composition, this difference disappeared. (6 refs.)

72353 Photoionization of deep impurity centers in semiconductors doped with transition elements. V.I.Kirillov, D.I.Materikin, S.I.Rembeza (Polytech. Inst., Voronezh, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1415-16 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2190-2 (Dec. 1982). [received: May 1983]
The authors calculate the photoionization cross section of deep centers whose ground state has a nonzero orbital quantum number *l*. They consider the case of transition element doped semiconductors where the not only potential scattering but also resonance scattering of a *l*-th partial Bloch wave by a d impurity occurs. (11 refs.)

72354 Experimental determination of the characteristics of deep centers in III-V crystals on the basis of a two-band model. N.M.Kolchanova, M.A.Sipovskaya, Yu.S.Smetannikova (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1418-19 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2194-6 (Dec. 1982). [received: May 1983]
The authors report the results of a comparison of the calculated dependences of the photoionization cross sections $\sigma=f(\hbar\omega)$ with the experimental data for a center in GaAs characterized by an ionization energy $\epsilon_i=0.75$ eV and a center with $\epsilon_t=E_v+0.13$ eV in InSb. An analysis shows that the ϵ_i center in GaAs is a donor of the *l*-c type with the Γ_6 symmetry, whereas the ϵ_t center in InSb is a donor center of the h type and with the Γ_8 symmetry. They investigated the impurity photoconductivity of high-resistivity GaAs in the photon energy range 0.6-1.5 eV. The activation energy of the deep level ϵ_i was 0.75 eV. (8 refs.)

Proceedings of the 16th International Conference on the Physics of Semiconductors .... See Entry 69780

Measuring method for electric field ionisation from trapping levels .... See Entry 70083

Stimulated emission from shallow donors localized by a strong magnetic field .... See Entry 71126

Tendency to nearly cubic local lattice structure around interstitial hydrogen in the alkali metals .... See Entry 71984

Ion-implantation associated defect production in silicon .... See Entry 71996

Influence of an electric field on the accumulation and annealing of radiation defects in gallium arsenide .... See Entry 72016

Thermodynamic properties of impurity band electrons .... See Entry 72135

Electronic states of doped semiconductors: a multiple scattering approach .... See Entry 72291

Bandwidth narrowing in n-type many-valley semiconductors .... See Entry 72300

On the conduction band edge energy of ice .... See Entry 72303

Excitation spectroscopy in silicon: pseudo-acceptor excited states of the isoelectronic A, B, C exciton system .... See Entry 72319

Low-energy surface exciton impurity states .... See Entry 72328

The total dielectric screening effect in III-V and II-VI compounds .... See Entry 72337

Negative temperature coefficient of the equilibrium carrier density in self-compensated β-SiC .... See Entry 72417

Hole density and degree of compensation of synthetic *p*-type diamond .... See Entry 72422

Spin-dependent recombination on dislocation dangling bonds in silicon .... See Entry 72425

Quantum oscillation of carrier concentation due to Fermi level pinning by doped indium impurities in $Pb_{1-x}Sn_xTe$ .... See Entry 72426

Photoconductive response of compensating impurities in photothermal ionization spectroscopy of high-purity silicon and germanium .... See Entry 72439

The effects of deep levels in GaAs MESFETs .... See Entry 72496

Variations of trap states and dangling bonds in CVD Si_3N_4 layer on Si substrate by NH_3/SiH_4 ratio .... See Entry 72527

Electron-nuclear interactions in semiconductors during optical pumping .... See Entry 72699

Optical polarization of nuclei in the presence of deep impurity levels .... See Entry 72704

On the Mossbauer isomer-shift studies of the electronic structure of semiconductors .... See Entry 72722

Electroabsorption in chromium-doped *p*-type GaAs .... See Entry 72771

Spectroscopic studies of 450°C thermal donors in silicon .... See Entry 72842

Photoluminescence of iron-doped $KMgF_3$ .... See Entry 72850

Radiative unstabilities in some triple electronic colour centre systems in ionic crystals .... See Entry 72858

The role of iodine for the luminescence of highly excited AgBr .... See Entry 72863

Isotope shifts for the P, Q, R lines in indium-doped silicon .... See Entry 72865

Observation of the internal luminescence of $Cr^{2+}(3d^4)$ in GaAs under hydrostatic pressure .... See Entry 72866

Effect of electron flux on radiation damage in GaAs solar cells .... See Entry 73442

71.55J Localization in disordered structures

72355 Reversible photoinduced modification of electron-capture cross section at localized states in *a*-Si:H. H.Okushi, M.Miyagawa, Y.Tokumaru, S.Yamasaki, H.Oheda, K.Tanaka (Electrotech. Lab., Ibaraki, Japan).
Appl. Phys. Lett. (USA), vol.42, no.10, p.985-7 (15 May 1983).
A reversible photoinduced modification of the electron-capture cross section at localized states in P-doped *a*-Si:H has been directly observed, being associated with the Staebler-Wronski effect. Isothermal capacitance transient spectroscopy measurement shows that the electron-capture cross section at the gap states located at around 0.5 eV below the conduction-band mobility edge (E_c) increases after the band-gap illumination and is nearly stored to its original value by thermal annealing below 200°C. It has been suggested that a metastable state related with the dangling bond is created through the multiphoton emission when excess carriers recombine. (16 refs.)

72356 Gap states in a-Si:H by photoconductivity and absorption. F.Evangelisti, P.Fiorini, G.Fortunato, A.Frova, C.Giovannella, R.Peruzzi (Istituto di Fisica 'G. Marconi', Univ. di Roma, Rome, Italy).
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.191-201 (May 1983).
The spectral dependence of photoconductivity in a series of a-Si:H samples has been analyzed in order to derive the absorption coefficient α. It has been found that the exponent β which relates photoconductivity and generation rate varies with photon energy and chopping frequency. Its critical influence upon the value of α is established. The Urbach tail in the region 1.4-1.8 eV has been studied and found to be independent of extrinsic gap states and hydrogen content. Finally an inverse correlation has been determined between the photoconductivity lifetime and the extrinsic gap-state density, as measured from the corresponding integrated area of the absorption coefficient. (14 refs.)

72357 Experimental tests of localization in semiconductors. G.A.Thomas (Bell Labs., Murray Hill, NJ, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.81-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The characteristic lengths of the electron wave function in a random three-dimensional system tend to diverge at a critical point at zero temperature and a density n_c. The results differ from predictions of Mott (1972, 1981) and of scaling theories of localization. The lengths associated with electron diffusion appear to be dominated by Coulomb interactions and electron-electron inelastic scattering. (15 refs.)

72358 Density of states and critical resistivity of strongly disordered systems. K.A.Muttalib (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4628-31 (15 April 1983).
Recently the author proposed that the anomalous diffusion at short length scales associated with localization is responsible for the unusual sensitivity of the high-T_c superconductors to disorder. It was shown that the Coulomb pseudopotential in superconductors is a universal function of ρ/ρ_c, where ρ is the resistivity and ρ_c is a critical resistivity characteristic of the system, and obtained relatively small values of ρ_c from the experimental T_c vs. ρ curves. In the present paper the author shows that the strong-disorder region in three dimensions the density of states is also a universal function of the same parameter, so that in the absence of any microscopic calculation of ρ_c, a comparison of the density of states and T_c as function of disorder provides a crucial test of the theory. Very good agreement is found with existing data on granular Al. The density of states has a logarithmic energy dependence in this region, a result independently obtained by Lee (1982). In addition, the author makes quantitative predictions about where and when to expect this logarithmic correction to be important, and comments on why it has not been observed yet. (7 refs.)

Comments on the theory of amorphous semiconductors .... See Entry 72295

AsF_5-doped polyparaphenylene: evidence for polaron and bipolaron formation .... See Entry 72331

Dependence of the gap on hydrogen content in a-Si:H .... See Entry 72846

71.65 POSITRON STATES

(see also 78.70B Positron annihilation)

Electron and positron response to atomic defects in solids: A theoretical study of the monovacancy and divacancy in aluminum .... See Entry 72349

71.70 LEVEL SPLITTING AND INTERACTIONS

(see also 75.10 – in magnetic phenomena, 75.30E Exchange and superexchange interactions, 73.20 Electronic surface states)

Crystal structure of $(DPPP)(TCNQ)_5(H_2O)$ and electrical properties of the mixed valence TCNQ salts of diquaternised 1,3-bis(4-pyridyl)propane .... See Entry 72394

The effect of pressure to 140 kbar on the electrical properties of $CeCu_2Si_2$ .... See Entry 72403

Relaxation of electron-phonon system in optically excited quasi-1-D mixed valence crystal Wolffram's red salt .... See Entry 72787

71.70C Crystal and ligand fields

72359 The absorption spectrum of d^2 ions in a trigonally distorted cubic crystal field. Ma Dong-ping, Hu Zhi-xiong, Xu Yi-sun (Chengdu Inst. of Agricultural Machinery, Pi Xian, China).
Acta Phys. Sin. (China), vol.32, no.3, p.366-75 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
By using the irreducible tensor operator method, two corollaries have been derived from generalized Wigner-Eckart theorem and the results associated with the corollaries are obtained. For the d^2 ions in a trigonally distorted cubic crystal field, the effective method dealing with overall problems of D, $g_\parallel$, $g_\perp$ and absorption spectrum has been suggested on the basis of unified model, in which all possible interaction of V_c and $(V_{tr}+H_s)$ have been considered. In application to vanadium corundum, successful results in agreement with the experiments are obtained by overall fitting of the theoretical values to the observed values of D, $g_\parallel$, $g_\perp$ and absorption spectrum. (14 refs.)

72360 Pseudo Jahn-Teller effect and distortion isomers of $CuBr_2(NH_3)_2$ crystals. T.Obert (Dept. of Chem. & Tech. Phys., Slovak Tech. Univ., Bratislava, Czechoslovakia), I.B.Bersuker.
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.568-73 (1983).
Relation of the values characteristic of pseudo Jahn-Teller effect to values which are characteristic of distortion isomerism of $CuBr_2(NH_3)_2$ coordination compound has been found. It follows from the results of this work that it is possible to explain the distortion isomerism of the compound mentioned before as a result of the pseudo Jahn-Teller effect. (15 refs.)

72361 Random fields in disordered magnetics with Jahn-Teller ions. M.A.Ivanov (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.26-38 (April 1983).
The character of distribution of random fields acting on a two-fold degenerate orbital E-term is investigated. The distribution functions for deformational and Coulomb fields caused by point defects are found. Random fields of exchange type on Jahn-Teller ions in crystals with a spinel structure are also examined. Estimates of distribution width for different fields are performed. The influence of random fields on the structure phase transition temperature and also on the behaviour of specific heat, elastic modul and magnetic anisotropy of crystals is analysed. (21 refs.)

Elastic and magnetoelastic effects in $TmAl_2$ and other $REAl_2$ compounds .... See Entry 72030

Magnetic properties of $REFe_2Si_2$ compounds .... See Entry 72636

EPR spectroscopy of single crystals using a two-circle goniometer .... See Entry 72661

Effect of quenching rate and annealing on ESR of Cu^{2+} and γ-induced Cd^+ in low alkali borate glasses .... See Entry 72664

State of Fe^{3+} ion and Fe^{3+}-F^- interaction in calcium fluorosilicate glasses .... See Entry 72665

Nature of the anisotropy of the spin-spin interaction of Co^{2+} ions in $A_2Zn(ZrF_6)_2.6H_2O$ crystals .... See Entry 72668

Electron-spin-resonance of some rare-earth ions in cubic intermetallic compounds ($AuCu_3$-structure) .... See Entry 72670

Γ_6-ground state resonance in (La, Er)B_6 single crystals .... See Entry 72671

ESR effects of singlet-triplet mixing in radical pairs. Determination of the individual *g* tensors and the exchange coupling constant from spectral shifts due to off-diagonal Zeeman terms .... See Entry 72673

Parameters of Cu nuclear spin Hamiltonian in mixed crystals $(CH_3NH_3)_2Cu(Cl_{1-x}Br_x)_4$ .... See Entry 72682

Study of the $[Co(CS_3)_3]^{3-}$ anion by UV-visible spectroscopy .... See Entry 72834

71.70E Spin-orbit coupling, Zeeman, Stark and strain splitting

72362 Unified theory of the electronic Stark effect in molecular crystals. R.W.Munn (Res. School of Chem., Australian Nat. Univ., Canberra, Australia).
Chem. Phys. (Netherlands), vol.76, no.2, p.243-8 (15 April 1983).
A compact expression for the energy of an assembly of polar polarizable molecules in an external electric field is derived with the help of the inverse dielectric function. The expression leads to an economical derivation of the energy shifts and splittings in the electronic Stark effect in molecular crystals. Previous results are unified by verifying their equivalence and correctness. (19 refs.)

72363 Volume dependence of the spin-orbit splitting in the copper halides. A.Blacha, M.Cardona, N.E.Christensen, S.Ves, H.Overhof (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.63-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Experimental data on the volume dependence of the spin-orbit splitting in CuCl, CuBr, and CuI are reported. The results are compared with ASA, KKR, and simple LCAO calculations. Information about the change in the p-d hybridization with pressure is obtained. (9 refs.)

Statistics of the levels in small metallic particles .... See Entry 72287

Surface magnetic structure analysis of Ni(001) by polarized electron diffraction .... See Entry 72584

ESR effects of singlet-triplet mixing in radical pairs. Determination of the individual *g* tensors and the exchange coupling constant from spectral shifts due to off-diagonal Zeeman terms .... See Entry 72673

71.70G Exchange interactions

72364 Structure and magnetism in a hydroxy bridged binuclear copper(II) system with a 'tunable' binuclear centre. L.K.Thompson (Dept. of Chem., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada).
Can. J. Chem. (Canada), vol.61, no.3, p.579-83 (March 1983).
The molecular structure of $[Cu_2(PAP)(OH)(IO_3)_3].4H_2O$ (PAP=1,4-di(2′-pyridyl)aminophthalazine) has been determined by single crystal X-ray diffraction $[Cu_2(PAP)(OH)(IO_3)_3].4H_2O$ belongs to the space group $P2_1/c$ with $a=7.266(1)$, $b=15.269(1)$, $c=25870(1)$ Å, $\beta=96.40(1)°$, $V=2852.2$ Å^3, $Z=4$. The copper coordination geometry lies between a square pyramid and a trigonal bipyramid and the two copper(II) centres are bridged by three groups: N_2 (phthalazine), hydroxide, and bidentate iodate, in a structure which is analogous to that reported for $[Cu_2(PAP)(OH)Cl_3].1.5H_2O$. Replacing the chlorine bridge by iodate has the effect of forcing the two metal centres further apart, thus creating a larger Cu-O-Cu bridge angle. This increase in oxygen bridge angle (101° to 114°) is also reflected in the enhanced antiferromagnetic exchange ($-2J(Cl)=201$ cm^{-1}, $-2J(IO_3)=335$ cm^{-1}). Other groups of varying size (e.g. Br, NO_3, SO_4) can act as bridges between the two copper centres in systems of this sort with the resultant variation in copper-copper separation and oxygen bridge angle. (33 refs.)

Exchange banding of excited core states and its effects on core-level spectroscopies .... See Entry 72299

Nature of the anisotropy of the spin-spin interaction of Co^{2+} ions in $A_2Zn(ZrF_6)_2.6H_2O$ crystals .... See Entry 72668

Observation of spin-split electronic states in solids by energy-, angle-, and spin-resolved photoemission .... See Entry 72948

71.70J Nuclear states and interactions

Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids .... See Entry 69773

Relaxation in ferromagnetic metals .... See Entry 72592

Magnetic properties of $REFe_2Si_2$ compounds .... See Entry 72636

EPR spectroscopy of single crystals using a two-circle goniometer .... See Entry 72661

Effect of quenching rate and annealing on ESR of Cu^{2+} and γ-induced Cd^+ in low alkali borate glasses .... See Entry 72664

Electron-spin-resonance of some rare-earth ions in cubic intermetallic compounds ($AuCu_3$-structure) .... See Entry 72670

ESR effects of singlet-triplet mixing in radical pairs. Determination of the individual *g* tensors and the exchange coupling constant from spectral shifts due to off-diagonal Zeeman terms .... See Entry 72673

High-temperature investigations of NMR of ^{27}Al in dilute aluminium-zinc alloys .... See Entry 72681

Parameters of Cu nuclear spin Hamiltonian in mixed crystals $(CH_3NH_3)_2Cu(Cl_{1-x}Br_x)_4$ .... See Entry 72682

NMR of ^{27}Al in paramagnetic single-crystal $DyAl_2$ .... See Entry 72686

Simulation of quadrupole disturbed NMR field spectra by using the exact solution of the Hamiltonian: application to zinc .... See Entry 72691

NMR spin echoes and quadrupole effects in nickel single crystals .... See Entry 72697

Electron-nuclear interactions in semiconductors during optical pumping .... See Entry 72699

Optical polarization of nuclear angular momenta in amorphous Si-Dy .... See Entry 72700

Optical polarization of nuclei in the presence of deep impurity levels .... See Entry 72704

Optical alignment of the bound electron-nuclear spin system of a semiconductor .... See Entry 72705

Effect of the field due to optically aligned electrons in a semiconductor on the polarization of nuclei in an inclined magnetic field .... See Entry 72707

Resonance cooling of the nuclear spin system of a semiconductor with optically aligned electrons: experimental part .... See Entry 72708

Resonance cooling of the nuclear spin system in a semiconductor with optically aligned electrons: theoretical part .... See Entry 72709

Resonant cooling of the spin system of a superconductor lattice nuclei following optical orientation of the electrons [for superconductor read semiconductor] .... See Entry 72711

Influence of the distribution of carbon atoms on the quadrupole interaction in Fe-Ni-C austenite .... See Entry 72716

Measurements of the hyperfine magnetic fields at Ta and Fe in the Laves compound $(Zr_xHf_{1-x})Fe_2$ for $0 \leq x \leq 1$ .... See Entry 72718

Analytical solution for the ^{57}Fe Mossbauer spectra for octahedral cage hopping and correlated electric field gradient fluctuations .... See Entry 72719

Mossbauer spectroscopy of laser annealed tellurium implanted silicon. II. ^{129}I .... See Entry 72721

Muon spin rotation in antiferromagnetic oxides .... See Entry 72724

Optical alignment in semiconductors .... See Entry 72844

72.00 ELECTRONIC TRANSPORT IN CONDENSED MATTER

(for surfaces, interfaces, and thin films, see 73.)

72.10 THEORY OF ELECTRONIC TRANSPORT; SCATTERING MECHANISMS

72365 A thermodynamic development of generalized Fourier and Ohm conduction laws for anisotropic materials. Y.Ersoy (Dept. of Engng. Sci., Middle East Tech. Univ., Ankara, Turkey).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.835-40 (1983).
Referring to the residual entropy inequality previously derived, the classical Fourier and Ohm conduction laws are generalized for magnetothermoelectrical rigid continuous solids. From these constitutive equations the Maxwell-Cattaneo equation of heat conduction and the Newtonian-Ohm law of electrical conduction come out in a natural way. To describe rather general thermoelectrical effects and the conducting free energy in a linear theory, it is shown that at most six material tensors are needed. (7 refs.)

72366 Kinetics of electron scavenging in bond-disordered media. N.I.Chekunaev, Yu.A.Berlin, V.N.Fleurov (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
J. Phys. C (GB), vol.16, no.13, p.2569-82 (10 May 1983).
A new kinetic theory of electron scavenging controlled by non-classical electron transport in disordered solids has been developed. This theory is based on the percolation approach to the description of a trap-to-trap tunnelling motion of electrons in solid systems with a bond disorder. Such an approach is applied to determine the concentration of trapped electrons as a function of time for a disordered medium containing randomly placed, immobile scavengers. Two limits of direct physical significance have been considered in detail, i.e. the cases when the concentration of trapped electrons is either much less or equal to that of scavenging molecules. The comparison between present results and those obtained by other authors is discussed. (26 refs.)

72367 Friedel sum rule in the second Born approximation. B.K.Agarwal, N.Singh (Dept. of Phys., Allahabad Univ., Allahabad, India).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.319-20 (9 May 1983).
The condition on the impurity potential is derived using the second Born approximation for the phase shift occurring in the Friedel sum rule. The result distinguishes between the donor-and acceptor-type scattering centers. (8 refs.)

72368 Critical behavior of the low-field Hall conductivity at a percolation threshold. D.J.Bergman (Dept. of Phys., Ohio State Univ., Columbus, OH, USA), Y.Kantor, D.Stroud, I.Webman.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1512-15 (9 May 1983).
The critical behavior of the low-field Hall effect in a three-dimensional metal-nonmetal composite near the percolation threshold has been determined for the first time from calculations on a reliable random-resistor-network model. The Hall coefficient R_e is found to diverge as $|p-p_c|^{-g}$, where $g=0.29 \pm 0.05$. (24 refs.)

72369 On the role of the soliton mechanism in the electron transfer along the quasi-one-dimensional molecular structures. M.Sataric (Faculty of Tech. Sci., Inst. of Appl. Fundamental Sci., Novi Sad, Yugoslavia), R.Zakula.
Phys. Status Solidi b (Germany), vol.116, no.2, p.617-32 (1 April 1983).
An expression for the probability of electron transfer from a donor molecule (D) to an acceptor molecule (A) along a quasi-linear molecular chain (biopolymer), to which D and A are attached is derived. Investigated is the case with an indirect interaction caused by modification of Coulomb interaction due to electron transition from D to A and vice versa via a periodical structure, in addition to the direct, resonant interaction of D and A. The indirect interaction may lead to the electron capture by a soliton wave. The one-way transfer of an electron caused by relaxation phenomena for the dynamical system in contact with a thermostat ($T=0$K) is discussed. (11 refs.)

72370 Frequency dependence of the conductivity in presence of an electric field in one dimension: Weak-disorder limit. B.Derrida (Service de Phys. Theorique, CENS, Gif-sur-Yvette, France), R.Orbach.
Phys. Rev. B (USA), vol.27, no.8, p.4694-701 (15 April 1983).
The frequency dependence of the electrical conductivity is examined for a classical hopping model of a random one-dimensional system in the presence of a superposed static electric field. The effect of the field is taken as a constant bias for the left-right jump rates. A general expression is derived for the mean velocity and frequency-dependent conductivity. Explicit evaluation of these equations is given for correlated and uncorrelated hopping rates: (1) in general for high frequencies and (2) to lowest order in the disorder for all frequencies. In the latter case, an initial decrease in $\sigma(\omega)$ for very small ω is found, $\sigma_R=a_0-a_1\omega^2$, $\sigma_I=a_2\omega^3$. For larger frequencies, the conductivity crosses over to the form $\sigma(\omega)=b_0+b_1(i\omega)^{1/2}$, previously calculated by Alexander and Orbach (1981). The a_i, b_i are constants which depend on the strength of the bias and the randomness. The crossover frequency increases with the bias. In addition, the variance in the autocorrelation function is calculated in the long-time limit, for weak disorder in the symmetric case. It is shown that fluctuations do not significantly affect the determination of this quantity under these conditions. (9 refs.)

Bill Bright Memorial Lecture—models for conduction in molecular solids .... See Entry 70755

72.15 ELECTRONIC CONDUCTION IN METALS AND ALLOYS

72371 Graphitized carbon fibers: a new electrical conductor with high strength to weight properties. J.S.Murday, D.D.Dominguez (Naval Res. Lab., Washington, DC, USA).
Nav. Res. Rev. (USA), vol.35, no.1, p.2-13 (1983).
The authors discuss graphitized carbon fibers and show that the mechanical and electrical properties of the fibers approach those of the a-axis of graphite. A comparison of the graphite properties to those of some common metal alloys is presented. The properties of the graphite a-axis are equivalent or better in all respects except for a deficiency of 10-20 in electrical conductivity. However, there are known ways to chemically modify the graphite by intercalation which improve the conductivity by factors of 10-20. The suitability of this chemical modification to fibers and its long-term stability are considered. Finally, the high cost of graphitized carbon fibers and its reduction by improved manufacturing technology is discussed. (22 refs.)

72.15C Electrical and thermal conduction in amorphous and liquid metals and alloys

72372 Resistance of the amorphous magnetic alloy $Fe_{29}Ni_{49}P_{14}B_6Si_2$ as a function of temperature and stress. R.S.Parashar, A.K.Bhatnagar (School of Phys., Univ. of Hyderabad, Hyderabad, India).

J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.56-60 (April 1983).

The stress and temperature dependence of the electrical resistivity of amorphous alloy ribbon $Fe_{29}Ni_{49}P_{14}B_6Si_2$ in the range 77-440K is reported. Tensile stress was applied along the long ribbon axis. Results obtained on the temperature dependence of $\Delta R/R_{300}$ show that at low temperatures (<320K) the tensile stress has an effect of increasing the slope while at high temperature it seems to be reversed, indicating the initiation of enhanced structural relaxation process. Curie temperature is found to increase with application of the tensile stress. Ferromagnetic resonance (FMR) and scanning electron microscope observations show that the applied tensile stress induces crystallization into the specimen which is reflected through broad FMR peaks. Crystallites seem to be elongated parallel to the direction of the applied stress. (17 refs.)

72373 Electrical transport in low-resistivity amorphous metals. L.V.Meisel, P.J.Cote (Large Caliber Weapon Systems Lab., US Army Armament Res. & Dev. Command, Watervliet, NY, USA).

Phys. Rev. B (USA), vol.27, no.8, p.4617-27 (15 April 1983).

Diffraction-model calculations incorporating appropriate scattering matrix elements and phonon-ineffectiveness effects (saturation effects) yield results which are consistent with the observed temperature dependence of the electrical resistivity in low-resistivity ($\rho<100$ $\mu\Omega$cm) amorphous alloys. In particular, remarkably good quantitative agreement with available detailed resistivity measurements in *a*-MgZn alloys has been obtained by these methods. The results further indicate that saturation effects, which dominate the temperature dependence of the high-resistivity amorphous metals, are important even for resistivities as low as 50 $\mu\Omega$ cm. (40 refs.)

72374 Effect of hydrogen and deuterium on electronic-transport properties of the metallic glass $Pd_{0.76}Cu_{0.06}Si_{0.18}$. S.Basak (Dept. of Phys., Univ. of Chicago, Chicago, IL, USA).

Phys. Rev. B (USA), vol.27, no.8, p.4754-9 (15 April 1983).

The effect of hydrogen and deuterium on the temperature dependence of resistivity ρ and thermoelectric power S for the metallic glass $Pd_{0.76}Cu_{0.06}Si_{0.18}$ is reported. Between 4.2 and 296K it was found that the addition of hydrogen increases ρ and decreases its temperature coefficient $\alpha=(1/\rho)d\rho/dT$. For $4.2<T<90$K the extra resistivity due to hydrogen $\Delta\rho(T)$, decreases with increasing T in a manner best fitted by the form $a-b[\ln(T/T_K)]^2$, where a, b are constants and $T_K=1$K. For the unhydrogenated glass S is small, negative, and linear in T with a negative slope throughout the range $25<T<210$K in which it was measured. Upon hydrogenation dS/dT becomes less negative. The isotope effect in $[\Delta\rho(T)/\Delta\rho(296\text{K})]$ is very small. These data are discussed in the light of two current models of electronic transport in amorphous metals. (28 refs.)

Structure and electrical properties of amorphous Ni-P thin films [thin film resistors] .... See Entry 72280

72.15E Electrical and thermal conduction in crystalline metals and alloys

On a new ternary arsenide $NiNbAs_2$: structure and properties .... See Entry 71928

Electrical properties of sintered $EuTiO_3$-$EuNbO_3$ .... See Entry 72392

Electromagnetic excitations in noble metals .... See Entry 72674

Approximate theory of FMR and AR in weakly conducting ferromagnetic bulk metals .... See Entry 72679

Isostatic shaping of parts in a heat-resisting nickel alloy .... See Entry 73029

Structure and properties of permeable fine-fiber materials produced from powders .... See Entry 73157

72.15G Galvanomagnetic and other magnetotransport effects

72375 Nature of a double magnetoresistance peak observed in magnetic breakdown in aluminium. V.L.Ginzburg, V.N.Morgun (A.M. Gorki State Univ., Kharkov, Ukrainian SSR).

Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.459-67 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*

Theoretical studies are made of the characteristic features of the magnetoresistance of aluminium under magnetic breakdown conditions in a narrow range of tilt angles (~3°) of a magnetic field H relative to a fourfold symmetry axis. A calculation is made of the contribution of magnetic breakdown electrons to the conductivity in the case of one- and two-dimensional configurations of electron orbits. The dependences obtained are compared with the experimental data. Weakly temperature-dependent oscillations of the transport coefficients are predicted for the case of two-dimensional magnetic breakdown. (14 refs.) *A.T.*

72376 Two-current conduction model and anisotropic magnetoresistance in transition metal-metalloid glasses. S.N.Kaul (Inst. fur Experimental Phys. IV, Ruhr Univ. Bochum, Bochum, Germany).

Phys. Status Solidi b (Germany), vol.116, no.2, p.K99-104 (1 April 1983).

The results of anisotropic magnetoresistance (AMR) measurements are presented for some Fe-B and Co-B metallic glasses with Fe (Co) replaced by Co, Ni (Ni) and also for amorphous $(Fe\text{-}Ni)_{80}B_{20}$ and $(Fe\text{-}Ni)_{80}P_{14}B_6$ alloys. The author discusses these results in the light of various theoretical models. (17 refs.)

Localization and correlation effects in metals and semiconductors—experiment .... See Entry 72341

Critical behavior of the low-field Hall conductivity at a percolation threshold .... See Entry 72368

Importance of electron-phonon processes in the inelastic lifetime of conduction electrons .... See Entry 72377

Dependence of the magnetoresistance on dispersion properties of Permalloy films with allowance for the angular spatial dispersion of the anisotropy .... See Entry 72518

Characteristics of the Hall effect in two-layer iron and cobalt films .... See Entry 72519

The empirical correlations between phonon spectrum parameters λ, $\langle\omega\rangle$, $\langle\omega^2\rangle$ and the Hall coefficients of amorphous superconductors .... See Entry 72529

72.15H Thermomagnetic effects

Changes in the magnetic properties of amorphous alloy $Fe_5Co_{70}Si_{15}B_{10}$ caused by thermomagnetic treatment and the dependence of these changes on the initial state of alloy .... See Entry 72630

72.15J Thermoelectric effects

Effect of hydrogen and deuterium on electronic-transport properties of the metallic glass $Pd_{0.76}Cu_{0.06}Si_{0.18}$ .... See Entry 72374

Electrical properties of sintered $EuTiO_3$-$EuNbO_3$ .... See Entry 72392

72.15L Relaxation times and mean free paths

72377 Importance of electron-phonon processes in the inelastic lifetime of conduction electrons. G.Bergmann (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).

Solid State Commun. (USA), vol.46, no.4, p.347-9 (April 1983).

The temperature of conduction electrons can be raised above the lattice temperature by a high electric current density. The achieved temperature difference is proportional to the electron-phonon relaxation time. Weak localization yields information about the electron temperature and allows the conclusion that electron-phonon processes are an essential determinant for the inelastic lifetime of the conduction electrons. (16 refs.)

72.15N Collective modes, e.g. in one-dimensional conductors

72378 Threshold behavior of charge-density waves pinned by impurities. D.S.Fisher (Bell Labs., Murray Hill, NJ, USA).

Phys. Rev. Lett. (USA), vol.50, no.19, p.1486-9 (9 May 1983).

A time-dependent mean-field theory of the nonlinear electric field response of a charge-density wave pinned by impurities is implemented. It is found that above a threshold electric field E_T, the charge-density wave moves with velocity $v\propto(E\text{-}E_T)^{3/2}$. Some general discussion of the behavior as a function of dimension is included. (16 refs.)

72379 Charge density wave transport in $(TaSe_4)_2I$. Z.Z.Wang, M.C.Saint-Lager, P.Monceau, M.Renard (CNRS, Grenoble, France), P.Gressier, A.Meerschaut, L.Guemas, J.Rouxel.

Solid State Commun. (USA), vol.46, no.4, p.325-8 (April 1983).

The authors report nonlinear transport properties below the metal-insulator transition temperature $T_0=263$K in the halogened metal transition tetrachalcogenide $(TaSe_4)_2I$. These non linear properties are similar to those of $NbSe_3$ and TaS_3 and indicate that $(TaSe_4)_2I$ is a new compound exhibiting charge density wave transport. (14 refs.)

72380 Low-temperature electrical conductivity of a quasi-one-dimensional substance $Hg_{3-\delta}AsF_6$ ('alchemist's gold'). S.I.Mukhin (Inst. of Steel & Alloys, Moscow, USSR).

Sov. Phys.-JETP (USA), vol.56, no.2, p.350-8 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.634-8 (Aug. 1982). [received: May 1983]

A derivation is given of the transport equation for the electron-phonon interaction in a quasi-one-dimensional compound $Hg_{3-\delta}AsF_6$. It is shown that this gives rise to different temperature dependences of the electrical conductivity in two adjoining temperature ranges below the Debye value. At the lowest temperatures the scattering by thermal phonons near singular parts of the Fermi surface is important. At higher temperatures, in the case of a sufficiently large curvature of the planes forming the Fermi surface, the scattering of electrons by short-wavelength phonons predominates. The existence of two mutually perpendicular pairs of Fermi planes in $Hg_{3-\delta}AsF_6$ determines the characteristics of the relaxation of quasimomentum in this system. The theory is in qualitative agreement with experiment. (15 refs.)

72381 Stabilization under pressure of the metallic state in electrically conducting organic tetraselenotetracene salts $(TSeT)_2Br_xCl_{1-x}$. A.V.Zvarykina, V.N.Laukhin, E.E.Yurchakevich, E.B.Yagubskii (Inst. of Chem. Phys., Acad. of Sciences, USSR).

Sov. Phys.-JETP (USA), vol.56, no.2, p.448-51 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.799-805 (Aug. 1982). [received: May 1983]

Under an applied hydrostatic pressure, tetraselenotetracene complexes of composition $(TSeT)_2Br_xCl_{1-x}$ ($0\leq x\leq 1$) undergo a first-order phase transition to a new metallic state which is stable on cooling over the whole temperature range down to 1.3K. The pressure at which this transition takes place decreases linearly with increasing x from 5 kbar for $(TSeT)_2Cl$ to 2.2 kbar for $(TSeT)_2Br$. The resistance of the high-pressure phase of the complexes studied falls practically linearly with decreasing temperature and below 10K becomes the residual resistance characteristic of each composition. (14 refs.)

Phase diagram and critical temperatures of nearly half-filled quasi one-dimensional conductors .... See Entry 72532

Raman scattering in quasi-one-dimensional $ZrTe_5$ .... See Entry 72810

72.15Q Scattering mechanisms and Kondo effect

(see also 75.20H Local moments in dilute alloys)

Electrical transport in low-resistivity amorphous metals .... See Entry 72373

Importance of electron-phonon processes in the inelastic lifetime of conduction electrons .... See Entry 72377

The effect of pressure to 140 kbar on the electrical properties of $CeCu_2Si_2$ .... See Entry 72403

72.20 CONDUCTIVITY PHENOMENA IN SEMICONDUCTORS AND INSULATORS

(for nonelectronic thermal conduction, see 66.70)

72.20D General theory, scattering mechanisms

72382 Longitudinal diffusion of nonequilibrium carriers in thin semiconductors. V.N.Ovsyuk (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1383-6 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2146-51 (Dec. 1982). [received: May 1983]
A theoretical study is made of the diffusion of nonequilibrium carriers along the surface of a semiconductor in the case when a space charge layer is present near the surface. It is shown that in the case of doped semiconductors with a sufficiently wide gap or at low temperatures there is a certain limiting value of the surface band bending above which the longitudinal diffusion length becomes greater than the real length of a sample. The dependences of the characteristic distances in longitudinal diffusion and lateral photo-EMF on the surface potential and steady-state illumination are obtained. (11 refs.)

Comments on the theory of amorphous semiconductors .... See Entry 72295

72.20F Low-field transport and mobility; piezoresistance

72383 Proton and deuteron bombarded $Ga_{0.47}In_{0.53}As$. K.Steeples, G.Dearnaley (AERE Harwell, Didcot, England), I.J.Saunders.
Appl. Phys. Lett. (USA), vol.42, no.8, p.703-5 (15 April 1983).
Large increases in resistivity of $Ga_{0.47}In_{0.53}As$ have been observed due to bombardment with hydrogen ion isotopes. After damage factors due to mass and dose of the implanted isotopes have been taken into account, the high resistivity values of proton and deuteron bombarded $Ga_{0.47}In_{0.53}As$ agree, contrasting with previous observations in GaAs. An explanation is offered. (7 refs.)

72384 Measurements of electrical conductivity of impurity binary solutions. J.Piotrowska-Szczepaniak (Inst. of Phys., Silesian Univ., Katowice, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.579-82 (April 1983).
Presents results of measurements of electrical conductivity for the binary solution nitrobenzene-hexane with critical x_c and noncritical concentration, pure and also doped by CCl_4. In the two-phase region the temperature dependence of electrical conductivity satisfies the equation: $|\sigma_1\text{-}\sigma_2| = A\epsilon^\beta$ where $\epsilon=(T\text{-}T_c)/T_c$ with $\beta=0.35\pm0.05$. Introduction of an impurity does not change the value of the critical index. (5 refs.)

72385 Electrical conductivity of single crystal nickel tungstate. R.Bharati, R.A.Singh (Dept. of Phys., Univ. of Gorakhpur, Gorakhpur, India), B.M.Wanklyn.
J. Mater. Sci. (GB), vol.18, no.5, p.1540-2 (May 1983).
Measurements of a.c. and d.c. electrical conductivity in crystals of nickel tungstate, in the temperature range 300 to 1100K, are presented. $NiWO_4$ is found to be a semiconductor with a band gap of 2.10 eV. The nature of the electrical conduction is discussed in the light of various conduction models. (16 refs.)

72386 Field-property bounds for porous sintered ceramics. P.Nikolopoulos (Dept. of Chem. Engng., Univ. of Patras, Patras, Greece), G.Ondracek.
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.238-41 (April 1983).
Three sets of equations provide upper and lower values bounding the experimentally obtained electrical and thermal conductivities as well as the magnetic permeabilities (≃'field properties') of porous ceramics. These equations are as I-order upper bound: $\phi_P=\phi_M(1-P)$ (ϕ_P=effective field property of the porous material, ϕ_M=field property of the nonporous material, P=porosity), and as I-order lower bound; $\phi_P=\phi_M(1-P)^7$. Closer bounds corresponding to isotropic porous materials are the II-order upper bound: $\phi_P{}^{I\text{-}I}=\phi_M[2(1-P)/(2+P)]$, and the II-order lower bound: $\phi_{PIII}=\phi_M(1-P)^3$. Even closer bounds, referring to isotropic porous materials containing closed, unconnected pores are the III-order upper bound: $\phi_P{}^{III}=\phi_M(1-P)^{3/2}$, and the III-order lower bound: $\phi_{PIII}=\phi_M(1-P)^3$. (31 refs.)

72387 Electronic conductivity, Seebeck coefficient, and defect structure of $La_{1-x}Sr_xFeO_3$ (x=0.1, 0.25). J.Mizusaki, T.Sasamoto, W.R.Cannon, H.K.Bowen (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.247-52 (April 1983).
The electrical conductivity and Seebeck coefficients of $La_{1-x}Sr_xFeO_3$ (x=0.1, 0.25) were measured as a function of oxygen partial pressure, P_{O2}, at T=900° to 1300°C. The electrical conduction was p type in the higher P_{O2} range, and n type in the lower P_{O2} range. The Seebeck coefficient indicated that the conduction was due to electron hopping between Fe^x_{Fe} and Fd_{Fe} in the higher P_{O2} range and electron hopping between Fe'_{Fe} and Fe^x_{Fe} in the lower range. The carrier concentrations were calculated from the values of electrical conductivity and Seebeck coefficient. From the P_{O2} dependences of the carrier concentrations, the defect structure of $La_1\_Sr_xFeO_3$ was determined. It was found that the electrical properties can be described by considering the imperfections Sr'_{La}, $V_{\ddot{O}}$, Fe_{Fe}, and Fe'_{Fe}. (12 refs.)

72388 Electrical conductivity of 2,4-dinitrosoresorcinol and its complexes. M.S.Masoud, B.S.Farag, Y.A.Swan, T.M.Salem, M.M.El Essawy (Chem. Dept., Univ. of Alexandria, Alexandria, Egypt).
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.209-13 (May 1983).
Electrical conductivity measurements of 2,4-dinitrosoresorcinol (DNR) and its complexes were measured in the temperature range 20-115°C to give faint semiconducting behaviour for these systems. The conductivity values of the bis Co, Ni, Cu and Zn systems indicated that the metal ion forms a bridge between the two ligands facilitating the transfer of current carriers with some degree of delocalization in the excited state. As the iron content in the complexes increased, a gradual increase of electrical conductivity occurred, that might be due to lattice imperfections. (28 refs.)

72389 The resistivity inhomogeneity and the maximum possible mean resistivity of neutron-transmutation doped silicon. T.Gessner (Dept. of Phys., Tech. Univ. of Dresden, Dresden, Germany), B.Schmidt.
J. Phys. D (GB), vol.16, no.5, p.861-8 (14 May 1983).
Neutron-transmutation doping of silicon stimulates to a high degree the production of high resistivity n-type silicon, adjustable in the resistivity range of ρ_n=1...100 kΩ cm. Theoretical analysis of the resistivity inhomogeneities of neutron-transmutation doped silicon (NTD-Si) and the maximum possible mean resistivity as a function of the electrical parameters of the p-type Si starting material is presented. Theoretical and experimental results are compared in the resistivity range ρ_n=2-50 kΩ cm. (12 refs.)

72390 Electrical conduction in cobalt-phosphate glasses. C.A.Hogarth, M.J.Basha (Dept. of Phys., Brunel Univ., Uxbridge, England).
J. Phys. D (GB), vol.16, no.5, p.869-78 (14 May 1983).
Measurements are reported on the DC and AC conductivities of cobalt-phosphate glasses over a temperature range from room temperature to 553K. A polaronic model is shown to be generally applicable to conduction in these materials. The results of the AC measurements are indicative of a hopping process of some kind. (15 refs.)

72391 Ternary copper oxides with the rutile structure: the compounds $Ti_{1-x}Cu_{x/3}Nb_{2x}/_3O_2$. A.Grandin, M.M.Borel, C.Michel, B.Raveau (Lab. de Cristallographie, Chimie et Phys. du Solide, L.A. ISMRA, Univ. de Caen, Caen, France).
Mater. Res. Bull. (USA), vol.18, no.3, p:239-46 (March 1983).
A copper titanoniobate $Ti_{1-x}Cu_{x/3}Nb_{2x/3}O_2$, with rutile structure, has been synthesized for $0\leq x\leq 0.9$, and its crystallographic data have been determined. The study of its electrical and magnetic properties, shows that this solid solution is an n-type semiconductor, whose conductivity increases with the copper content from 10^{-7} $(\Omega\ cm)^{-1}$ for x=0.10 to 10-^{-4} $(\Omega\ cm)^{-1}$ for x=0.80 at room temperature. A succinct investigation of the system $CuTa_2O_6\text{-}TaO_2$, allowed the authors to obtain isostructural oxides with similar conductivities indicating that the 3d titanium orbital is mainly involved in the conduction band of these oxides. The ESR spectra of Cu^{II} ions in these oxides have been obtained at 77K. They suggest nonlinear Cu^{2+} ion pair interactions in the range $0.02\leq x\leq 0.20$. (17 refs.)

72392 Electrical properties of sintered $EuTiO_3\text{-}EuNbO_3$. K.Ishikawa, G.-y.Adachi, J.Shiokawa (Dept. of Appl. Chem., Osaka Univ., Osaka-fu, Japan).
Mater. Res. Bull. (USA), vol.18, no.3, p.257-62 (March 1983).
Two-phase sintered products $[yEuTiO_3+(1\text{-}y)EuNbO_3]$ were investigated as electrical-resistor materials. Electrical resistivities of the products did not depend on y in the range $0<y<0.96$, and rapidly incresed with increasing y over y=0.96, and were semiconductors at $y>0.96$. Thermal coefficients of resistivity for sintered products varied continuously with y, and became a maximum of 2.8×10^{-3} K^{-1} at y=0.75 and a minimum around y=1.00. The coefficient was positive at $y<0.96$ and negative at $y>0.96$. The absolute value of the thermal coefficient of resistivity took a minimum value when $(1/\rho)$ $(d\rho/dT)=0$, at y=0.96. (7 refs.)

72393 Preparation and electrical conductivity of $Cr_2V_2WO_{10}$ and $Cr_2Nb_2WO_{10}$ with the rutile structure. K.R.Nair, M.Greenblatt, W.H.McCarroll (Dept. of Chem., Rutgers Univ., New Brunswick, NJ, USA).
Mater. Res. Bull. (USA), vol.18, no.3, p.309-14 (March 1983).
Polycrystalline samples of $Cr_2V_2WO_{10}$ and $Cr_2Nb_2WO_{10}$, isostructural with the rutile type $FeNbO_4$ have been prepared. The compounds are nonstoichiometric with respect to all the constituent metal ions. Their crystallographic parameters and electrical resistivities have been characterized. The stabilization of rutile structure in these compounds is attributed to electronic effects. (15 refs.)

72394 Crystal structure of $(DPPP)(TCNQ)_5(H_2O)$ and electrical properties of the mixed valence TCNQ salts of diquaternised 1,3-bis(4-pyridyl)propane. G.J.Ashwell (Dept. of Chem., Sheffield City Polytech., Sheffield, England), S.C.Wallwork, P.J.Rizkallah.
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.359-69 (1983).
The conductivities and thermoelectric EMFS of an isostructural series of TCNQ salts are reported together with the crystal structure of $(DPPP)(TCNQ)_5(H_2O)$, representative of the series. The 1:5 salt has a monoclinic subcell, space group $P2_1/c$, with a=12.73(2), b=3.87(2), c=28.47(10) Å, β=107.9(4)°. The TCNQs stack plane-to-plane in columns, parallel to **b**, with (i) an average interplanar spacing of ~3.3 Å and (ii) an exocyclic double bond to quinonoid ring overlap of adjacent molecules. The hydrated cation lattice shows no long-range order. $(DPPP)(TCNQ)_5(H_2O)$ and its isostructural congeners, $(DHPP)(TCNQ)_4(H_2O)$, $(DMPP)(TCNQ)_{4-1/2}(H_2O)$ and $(DEPP)(TCNQ)_5(H_2O)$, are small band gap semiconductors. The room temperature conductivities, determined parallel to **b**, are in the range 0.05 to 100 S cm^{-1}. (24 refs.)

72395 Resolution of the conductivity dilemma in liquid solutions of alkali metals in alkali halides. W.W.Warren,Jr., S.Sotier, G.F.Brennert (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1505-8 (9 May 1983).
Nuclear magnetic resonance measurements are reported for liquid Na-NaBr, Cs-CsCl, and Cs-CsI solutions containing less than 10 mole% metal. Correlation of the resonance shifts, relaxation rates, and DC electrical conductivity shows that the electronic mobility is independent of concentration in Na-NaBr, in sharp contrast with the cesium solutions. The results provide an explanation for the apparently anomalous electronic conductivity observed in liquid-sodium-sodium-halide solutions. (22 refs.)

72396 The non-parabolicity of the n-Si conduction band caused by elastic deformation along the [111] direction. P.I.Baranskii, V.V.Kolomoets, S.S.Korolyuk (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K109-12 (1 April 1983).
The authors study the piezoresistance of n-Si arising at uniaxial elastic deformation along the [111] direction (in absence of current carrier redistribution between individual valleys) due to the deformation-induced change of the effective mass. (4 refs.)

72397 Electrical conductivity of amorphous V_2O_5. C.Sanchez, R.Morineau, J.Livage (Lab. de Spectrochimie du Solide, Univ. Pierre et Marie Curie, Paris, France).
Phys. Status Solidi a (Germany), vol.76, no.2, p.661-6 (16 April 1983).
Electrical conductivity of bulk amorphous V_2O_5 obtained by splat cooling is measured in the temperature range 360 to 150K. A continuous decrease of the activation energy W deduced from a plot of ln (σT) vs. T^{-1} is observed in the whole range. Such a behaviour is typical of small polaron hopping in amorphous transition metal oxides. The temperature dependence of the electrical conductivity is analyzed according to two different models. The first one describes the structural disorder as a random distribution of the potentials while the second one, suggested by Killias, takes into account a random distribution of the hopping distances. Both models agree with the experiments and yield values in good agreement with previous results obtained with amorphous V_2O_5 thin films and V_2O_5 based glasses. (24 refs.)

72398 Quantum correlations to conductivity and energy relaxation in InP and InSb. A.P.Long (Cavendish Lab., Univ. of Cambridge, Cambridge, England), M.Pepper.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.75-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors present results on conduction in the metallic impurity band of InP at low temperatures. Below 4K, in zero magnetic field, they observe a $T^{1/2}$ correction to the conductivity consistent with the Coulomb interaction model, although the sign of the change is not in agreement with theory. The

observation of a negative magnetoresistance also indicates the role of localization in the conduction process and the authors have attempted to separate the two mechanisms by measuring for both $\omega_c\tau<1$ and $\omega_c\tau>1$. They have measured the energy relaxation time in InSb for various electron and lattice temperatures. The results are discussed in terms of energy loss via acoustic piezoelectric, deformation potential and polar optical scattering. They have measured the electronic specific heat on the insulating side of transition and find it is consistent with a small density of states, but not a gap. (11 refs.)

72399 Investigation and analysis of the temperature dependence of the Hall effect in liquid tellurium. V.M.Glazov, V.B.Kol'tsov (Inst. of Electronic Technol., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1368-70 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2121-5 (Dec. 1982). [received: May 1983]
A precision method and highly accurate electronic apparatus were used to investigate the temperature dependences of the electrical conductivity, thermoelectric power, and Hall effect of tellurium near the melting point both in the solid and liquid states. The changes in the properties observed on heating the melt were attributed to changes in the volume fraction of the chain component of the structure, calculated from the viscosity data. Calculations of the Hall coefficient carried out on a structure model of liquid tellurium allowing for the spin-orbit interaction gave results close to the experimental data. (15 refs.)

72400 Electrical conductivity of polycrystalline semiconductors. V.G.Kobka, R.P.Komirenko, Yu.V.Kornyushin, Yu.P.Medvedev, O.V.Tretyak (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1404-5 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2176-8 (Dec. 1982). [received: May 1983]
The authors consider the nature of electrical conduction of a unipolar semiconductor as a function of the grain size, degree of doping, and other parameters. They show that different types of conduction mechanism (from barrier to disordered) may occur depending on the relationships between the parameters. (8 refs.)

72401 Behavior of silicon in indium antimonide. M.N.Kevorkov, A.N.Popkov, N.S.Rytova, V.S.Uspenskii (State Sci.-Res. & Design Inst. of Rare-Metal Industry, Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1429-30 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2209-11 (Dec. 1982). [received: May 1983]
The authors study the influence of Si on the electrophysical parameters of indium antimonide. Electrical conductivity, carrier mobility and carrier density measurements are described at 77K. (8 refs.)

72402 Correlation of electrical resistivity and heat capacity of silicides of rare-earth metals with the composition R_5Si_4. Yu.V.Serdyuk, R.P.Krentsis, P.V.Gel'd (S.M. Kirov Ural Polytech. Inst., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1779-80 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3141-2 (Oct. 1982). [received: April 1983]
The authors have experimentally investigated the electrical and thermal characteristics of isostructural silicides of rare-earth metals with the composition R_5Si_4 (R=Cd, Tb, Dy, Ho), which are ordered ferromagnetically at low temperatures. The properties of these substances are described well within the framework of RKKY theory. The electrical resistivity of the silicides was measured in the temperature range from 4.2 to 360K by the standard potentiometric method. The heat capacity of silicides R_5Si_4 was studied with a low-temperature adiabatic calorimeter. (6 refs.)

72403 The effect of pressure to 140 kbar on the electrical properties of $CeCu_2Si_2$. F.G.Aliev, N.B.Brandt, V.V.Moshchalkov, V.I.Sidorov, R.V.Lutsiv (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1786-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3151-4 (Oct. 1982). [received: April 1983]
The authors have studied the temperature dependence of the resistivity $\rho(T)$ of single crystal $CeCu_2Si_2$ over the range of temperatures $1.8 \leq T \leq 300K$ at pressures p up to 140 kbar. They conclude that hydrostatic pressure induces a transition from a Kondo lattice state ($p \doteq 0$, $v=3.05$) to a state with a variable cerium valence ($p \lesssim 120$ kbar, $3<v<4$). This transition takes place smoothly; that is, the position of the 4f level and its occupation number are continuous functions of the pressure. Since $\rho(T)$ for $p=120$ and 140 kbar differ very little, it is probable that the cerium ions are already in the state Ce^{4+} for $p \gtrsim 120$ kbar. If the local maximum in $\rho_{300}(p)$ is interpreted in terms of the maximum density of 4f states passing through ϵ_F, then $p \simeq 65$ kbar corresponds to the state with an intermediate cerium valence $v=3.5$. (9 refs.)

Proceedings of the 16th International Conference on the Physics of Semiconductors .... See Entry 69780

Effect of argon implantation on the activation of boron implanted in silicon .... See Entry 71986

A correlation of atomic and electrical measurements of Cr and residual donors in thermally processed semi-insulating GaAs .... See Entry 72000

Problem of behavior of oxygen in Si .... See Entry 72001

Electrical properties of Te diffused silicon .... See Entry 72164

The effects of incorporating fluorine in amorphous germanium-silicon alloy films .... See Entry 72261

Metastable donor states in Te-doped $Ga_{1-x}Al_xSb$ compounds .... See Entry 72348

Energy spectrum of Sn and Ge impurity states in solid solutions based on lead chalcogenides .... See Entry 72352

Electrical properties of carbon-polymer composites .... See Entry 72406

Hole density and degree of compensation of synthetic *p*-type diamond .... See Entry 72422

Dependence of the Hall effect on the magnetic field in a model of an inhomogeneous narrow-gap semiconductor .... See Entry 72427

The influence of parameter nonuniformity on the two-dimensional Einstein relation in periodic and non-periodic semiconductor structures .... See Entry 72486

Magnetic properties of the compound $HfFe_2Si_2$ .... See Entry 72633

Metastable deexcitation spectroscopy and ultraviolet photoemission spectroscopy on electropolymerised polyacrylonitrile layer .... See Entry 72835

Effects in the optical and electrical properties of CdS crystals from the accumulation of structural defects under laser irradiation .... See Entry 72845

Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect .... See Entry 72882

Lattice disorder and electrical conductivity of flux-grown $Ca(WO_4)_x(MoO_4)_{1-x}$ crystals .... See Entry 72978

Electrical resistivity, magnetoresistance and microstructure of carbon-fiber/CVD-carbon composite .... See Entry 73056

Preparation, electrical resistivity and its temperature dependence of RuO_2-polystyrene composite powder .... See Entry 73061

A new relationship of DC conductivity with loss modulus in PET .... See Entry 73120

72.20H High-field and nonlinear effects

72404 Electron transport in InP at high electric fields. T.H.Windhorn, L.W.Cook, M.A.Haase, G.E.Stillman (Electrical Engng. Res. Lab., Univ. of Illinois at Urbana-Champaign, Urbana, IL, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.725-7 (15 April 1983).
The high field (>30 kV/cm) electron drift velocity in *n*-type (100) InP has been measured at temperatures from 95 to 400K and electric field strengths up to 215 kV/cm using a fixed frequency (7.54 GHz) microwave time-of-flight technique. The velocity decreases monotonically with increasing electric field strength at all temperatures over the entire range of field strengths investigated. At 300K the electron drift velocity in InP is 1.2 times the velocity in GaAs at 150 kV/cm, and increases to 1.34 times the velocity in GaAs when the field is lowered to 30 kV/cm. (20 refs.)

72405 Two-dimensional hot-electron transport in quantum-well structures of polar semiconductors. D.Chattopadhyay, A.Ghosal (Inst. of Radio Phys. & Electronics, Calcutta, India).
J. Phys. C (GB), vol.16, no.13, p.2583-6 (10 May 1983).
The drift velocity of hot electrons itinerant two dimensionally in a semiconductor quantum-well structure is calculated at different lattice temperatures on a displaced Maxwellian model. Interactions with deformation potential acoustic and polar optic phonons are considered using the analytic expressions obtained on the basis of a momentum conservation approximation. Contrary to a previous prediction, no negative differential resistance is obtained. (7 refs.)

72406 Electrical properties of carbon-polymer composites. E.K.Sichel, J.I.Gittleman (RCA Labs., Princeton, NJ, USA), P.Sheng.
J. Electron. Mater. (USA), vol.11, no.4, p.699-747 (July 1982). [received: Nov. 1982]
Both the experimental and theoretical aspects of the transport of electric charge in carbon black-polymer composites are reviewed. The morphology of these composites is discussed emphasizing its influence on the transport which is dominated by tunneling of electrons between adjacent carbon clusters and through the polymer film which separates them. The tunneling, which is enhanced by thermal fluctuations, leads to a resistivity $\rho(T) \propto \exp[T_1/(T+T_G)]$ at low electric fields and to nonlinear effects at high electric fields which are also a function of $T_1/(T+T_0)$. This tunneling mechanism is compared with the mechanisms dominant in cermets and amorphous semiconductors. (41 refs.)

72407 Resonance energy transfer in activationless hopping conductivity. A.A.Berezin (Dept. of Engng. Phys., McMaster Univ., Hamilton, Ontario, Canada).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1520-3 (9 May 1983).
Activationless hopping conductivity in a strong electric field is caused by downward jumps of localized carriers along the electric field. Here, the specific mechanism of energy release is considered, which involves an energy-transfer process when energy gained by a downward jump of one electron is radiationlessly transferred to another electron, allowing it to make an upward energy jump. An estimate shows that such processes may provide a noticeable contribution to the total hopping conductivity. (13 refs.)

72408 On *I-U* characteristics of semiconductor structures with inhomogeneous mobility profile. A.M.Belyantsev, M.N.Drozdov (Appl. Phys. Inst., Acad. of Sci., Gorkii, USSR).
Phys. Status Solidi a (Germany), vol.76, no.2, p.721-8 (16 April 1983).
The possibility of N- and S-shaped current-voltage characteristics of semiconductor structures with a inhomogeneous mobility profile is shown to appear in crossed electric and magnetic fields. This effect is due to the carrier redistribution. (12 refs.)

72409 Hot electron conduction of PbTe and $Pb_{1-x}Sn_xTe$. A.Krotkus, T.Lideikis, A.Plytnikas, I.Simkiene (Inst. of Semiconductor Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
Solid-State Electron. (GB), vol.26, no.6, p.605-9 (June 1983).
Experimental and theoretical studies have been made of electron transport and hot electron effects in PbTe and $Pb_{1-x}Sn_xTe$ as a function of alloy composition. Pulsed measurements of the current-voltage characteristic, Hall effect, and the potential distribution were made on epitaxial samples. Current instabilities and high field domain formation were observed. Monte-Carlo calculations of the velocity-field characteristic including the scattering into conduction band W-valleys were performed. Reasonable agreement was obtained for the threshold field dependence on alloy composition. (19 refs.)

72410 'Oblique' field domains as illustrated by the Sasaki effect in semiconductors. Z.S.Gribnikov (Inst. of Semiconductors, Acad. of Sci., Ukrainian SSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.401-5 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.718-26 (Aug. 1982). [received: May 1983]
In an isotropic semiconductor with negative differential resistance, the walls of the produced strong- and weak-field domains are inclined at an oblique angle to the current direction (and not at a right angle as in the isotropic case). The theory of such oblique field domains, with the Sasaki effect in a two-valley semiconductor as the example, is developed for samples with limited transverse dimensions. The distinguishing feature of this example is that the negative resistance and the anisotropy itself are induced by heating of the carriers in the longitudinal and transverse fields and are interrelated. The inclination angles of the oblique domain walls depend on the flowing current and in one of the limiting cases they can be almost parallel to the current direction. A correct value of a strong-field domain velocity can be obtained only if the inclination is taken into account. (10 refs.)

Charge density wave transport in $(TaSe_4)_2I$ .... See Entry 72379

Quantum correlations to conductivity and energy relaxation in InP and InSb .... See Entry 72398

About the transfer of the current of majority carriers at the absence of drift field when the avalanche local breakdown of the p-n junction develops .... See Entry 72485

Electric and photoelectric investigations of β-nickel phthalocyanine thin films .... See Entry 72525

72.20J Charge carriers: generation, recombination, lifetime, and trapping

72411 Diffusion length of holes in *n*-InP. V.Diadiuk, S.H.Groves, C.A.Arimento, C.E.Hurwitz (Lincoln Lab., MIT, Lexington, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.892-4 (15 May 1983).
By measuring the photocurrent as a function of reverse bias for InP photodiodes with a range of junction depths, the hole diffusion length L_p of epitaxial *n*-type InP ($n\sim1.5\$09M10^{16}$ cm^{-3}) was determined to be approximately 12 μm. This value of $L_p$is an order of magnitude larger than that determined by the electron beam induced current and surface photovoltage techniques. Reasons for these discrepancies, which involve geometrical and material considerations, respectively, are discussed. (14 refs.)

72412 On EBIC versus time measurements in thin semiconductor layers with the scanning electron microscope. A.Jakubowicz (Inst. of Electron Technol., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Phys. Status Solidi a (Germany), vol.76, no.2, p.729-34 (16 April 1983).
Recent results are given of EBIC vs. time measurements in thin semiconductor layers with the scanning electron microscope (SEM). This paper continues the discussion which started in a previous paper (see A. Jackubowicz, Solid-State Electron., vol.23, p.635, 1980). (7 refs.)

72413 Current transport across a grain boundary in polycrystalline semiconductors. Chih-Yuan Lu (Inst. of Electronics, Nat. Chiao Tung Univ., Hsin-Chu, Taiwan), N.Chau-Chun Lu.
Solid-State Electron. (GB), vol.26, no.6, p.549-57 (June 1983).
A unified approach to current transport across a grain boundary in polycrystalline semiconductors is developed. The resulting expressions for potential barrier and *J-V* characteristics are of general validity. The study concentrates on the carrier-trapping effect, and the trapping-state density can be monoenergetic, continuous, gaussian, or any reasonable distribution. By solving Poisson's equation under suitable boundary conditions without the depletion approximation, a single formulation is obtained for potential barriers in two adjacent grains with different sizes and doping levels. The grain-boundary scattering effect is approximated as a rectangular potential barrier. The voltage division of an applied bias across the junction is determined under the current-continuity conditions. A single expression with suitable computational simplicity is then presented for the *J-V* characteristics across the many-valley semiconductor/grain-boundary/semiconductor junction. (37 refs.)

72414 Carrier recombination and lifetime in highly doped silicon. J.G.Fossum, R.P.Mertens, D.S.Lee, J.F.Nijs (Dept. of Electrical Engng., Univ. of Florida, Gainesville, FL, USA).
Solid-State Electron. (GB), vol.26, no.6, p.569-76 (June 1983).
The predominance of phonon-assisted band-band Auger recombination in highly doped silicon is demonstrated by showing that no recombination mechanism involving common (unavoidable) defects in silicon can yield carrier lifetimes that are consistent with the measured lifetimes, which exhibit an inverse-quadratic doping-density dependence, and/or with their temperature dependence. Both trap-assisted-Auger and Shockley-Read-Hall recombination mechanisms are considered, and dependences of the defect density on the doping density, which are implied by theory and experiment, are accounted for. (38 refs.)

72415 Minority carrier recombination in heavily-doped silicon. M.S.Tyagi (Dept. of Electrical Engng., Indian Inst. of Technol., Kanpur, India), R.Van Overstraeten.
Solid-State Electron. (GB), vol.26, no.6, p.577-97 (June 1983).
A review of present understanding about the minority carrier recombination in silicon with dopant concentration in the range of 10^{18}-10^{20} cm^{-3} is presented. After providing a short phenomenological description of carrier recombination processes and lifetime, the main theories of carrier recombination in a semiconductor are briefly reviewed and their expected contributions to carrier recombination in silicon at heavy doping are indicated. The various methods used for measuring the minority carrier lifetime in heavily doped silicon are described and critically examined. Four different mechanisms are examined to explain the available lifetime data. (86 refs.)

72416 Carrier recombination at grain boundaries and the effective recombination velocity. W.Hwang, E.Poon, H.C.Card (Dept. of Electrical Engng., Columbia Univ., New York, NY, USA).
Solid-State Electron. (GB), vol.26, no.6, p.599-603 (June 1983).
The recombination of exces minority carriers at grain boundaries, or other interfaces with space-charge regions, is treated theoretically for general energy distributions of interface states (recombination centers). The distinction is made between minority carrier recombination velocity at the (grain-boundary) interface itself, and the effective recombination velocity for the collection of these carriers by the adjacent space-charge region. Calculations of the effective recombination velocity are made, as a function of the excess minority-carrier concentration at the edge of the space-charge region, since this is the quantity of most convenience for device modelling. (18 refs.)

72417 Negative temperature coefficient of the equilibrium carrier density in self-compensated β-SiC. L.S.Aivazova, V.L.Vinetskii, G.A.Kholodar' (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1355-7 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2100-4 (Dec. 1982). [received: May 1983]
Oxygen-doped β-SiC single crystals with relatively few defects exhibited a strong exponential fall of the equilibrium conduction electron density $n(T)$ on increase in temperature to 500K or higher. In a wide range of temperatures the dependence $n(T)$ was described satisfactorily by the concept of an equilibrium self-compensation of *n*-type conduction due to transformation of electrically inactive defects into new defects with an acceptor level. This transformation was stimulated by conduction electrons captured by the acceptor level of the new defects during their formation. (7 refs.)

72418 Cascade capture of carriers in semiconductors under dynamic conditions. V.Karpus, V.I.Perel' (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1373-6 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2129-35 (Dec. 1982). [received: May 1983]
A theory of the cascade capture of carriers is extended to the case of transient carrier generation and to the conditions of photothermal ionization. At low concentrations of the capture centers (traps), the lifetime is governed by the 'search' for centers. At high concentrations the dependences of the dynamic and static lifetimes (governed by the 'descent' time) on the initial carrier energy is important. It is shown that the dynamic lifetime is minimal for the generation of carriers into the percolation level and that it is equal to the time taken to lose an energy kT. (12 refs.)

72419 Drag of electrons by a longitudinal electric wave and sign of the drag force. L.E.Gurevich, V.S.Travnikov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1407-8 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2180-2 (Dec. 1982). [received: May 1983]
The authors consider the drag of electrons by a longitudinal electric wave (bulk plasmon) in a semiconductor; such a wave may be excited by fast electrons, X-rays, or light. The mechanism of the drag effect is very different from that of the drag by a transverse wave first considered by Barlow (1954). (11 refs.)

72420 Interband recombination of nonequilibrium carriers in p-type $Cd_xHg_{1-x}Te$ ($x\approx0.25$). N.L.Bazhenov, V.I.Ivanov-Omskii, N.N.Konstantinova, V.K.Ogorodnikov (AF Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1424-5 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2202-4 (Dec. 1982). [received: May 1983]
The authors report that in the case of p-type $Cd_x.Hg_{1-x}Te$ crystals with $x\approx0.25$ and a low concentration of recombination centers the temperature dependence of the carrier lifetime τ can be explained by the interband recombination mechanisms in a wide range of temperatures without invoking more complex models. The hole density and mobility in the investigated samples with $x\approx0.25$ were (1-4).10^{15} cm^{-3} and 300-350 cm^2.V^{-1}.sec^{-1}, respectively. A typical temperature dependence of the Hall coefficient R of one of the investigated samples is given. (9 refs.)

72421 Increase in the minority-carrier lifetime in GaAs as a result of irradiation and heat treatment. K.D.Glinchuk, N.S.Zayats, A.V.Prokhorovich (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1433-4 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2214 (Dec. 1982). [received: May 1983]
The effects of γ-ray irradiation and heat treatment on the minority-carrier lifetime in GaAs are described. Experiments were carried out on γ-irradiated tellurium-doped low-resistivity n-type GaAs crystals. The changes in the minority-carrier (hole) lifetime τ_h as a result of irradiation and heat treatment were deduced by measuring the photomagnetic EMF after irradiation and after subsequent annealing. (6 refs.)

72422 Hole density and degree of compensation of synthetic *p*-type diamond. O.G.Revin, V.N.Slesarev (Inst. of High-Pressure Phys. Acad. of Sci., Troitsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1436-8 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2219-21 (Dec. 1982). [received: May 1983]
Measurements were made of the electrical conductivity of synthetic *p*-type diamond single crystals in a narrow temperature range (283-293K) in order to determine the carrier scattering mechanism. The results and the data on the magnetoresistance and broadening of an acceptor level as a function of the concentration of electrically active impurities were used to determine the electrical resistivity, ionization energy of acceptors, degree of their compensation, hole density, and concentrations of acceptors and donors. Calculation formulas were derived for the electrical resistivity of octahedral samples. (11 refs.)

72423 Influence of the anisotropy of the probabilities of optical transitions of holes on the drag current in semiconductors of *p*-Ge type. E.Normantas, D.Gentsov, M.Moker (Inst. of Semiconductor Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1438-40 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2222-5 (Dec. 1982). [received: May 1983]
The authors calculate the drag current in Ge type semiconductors allowing for the anisotropy of the probabilities of optical transitions of holes due to their interaction with a transverse light wave. They ignore the optical heating of holes and calculate the current in the approximation of the relaxation times of the light holes τ_1 and the heavy holes τ_2, dependent only on the hole energies E_1 and E_2. The anisotropy of the probabilies of hole transitions in the case when holes are scattered by the lattice vibrations and impurities does not justify introduction of such relaxation times. However, since the relevant collision integrals require averaging over the wave vectors of holes, one can expect the anisotropy of the scattering of holes by phonons and impurities to have less effect on the photon drag current than the anisotropy of the probabilities of their optical transitions. (4 refs.)

72424 Thermally stimulated relaxation currents due to forces of nonelectrostatic origin. Yu.A.Gorokhovatskii, A.N.Gubkin, V.K.Malinovskii, B.I.Sturman (Moscow Electronic Engng. Inst., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.607-9 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.32-5 (July 1982). [received: May 1983]
It is shown that unusual thermally stimulated relaxation currents can arise in the external circuit on homogeneous heating of an insulator with a polar direction that is in a thermodynamically nonequilibrium state. These currents differ from thermally stimulated depolarization currents in being observed in a specimen that is unpolarized or has been depolarized. The temperature dependence of these relaxation currents is obtained for a particular model. (7 refs.)

72425 Spin-dependent recombination on dislocation dangling bonds in silicon. V.V.Kveder, Yu.A.Osip'yan, A.I.Shalynin (Inst. of Solid State Phys., Acad. of Sci., USR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.389-98 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.699-714 (Aug. 1982). [received: May 1983]
Spin-dependent recombination of free carriers via dislocation dangling bonds is investigated as a function of the temperature and of the light power in magnetic fields 0.04, 3.3, and 12.5 kOe. A model of the effect is proposed on the basis of an analysis of the obtained data. The model makes use of the concept of recombination via the dangling bonds, with preliminary capture of the carriers by intermediate shallow levels assumed to be due to the deformation potential of the dislocation. (25 refs.)

Measuring method for electric field ionisation from trapping levels ....See Entry 70083

Reversible photoinduced modification of electron-capture cross section at localized states in *a*-Si:H ....See Entry 72355

Behavior of silicon in indium antimonide ....See Entry 72401

Methodology for calculating turn-off transient of photoconductive circuit elements in picosecond optoelectronics ....See Entry 72443

Photoconductivity and hole transport in polymers of aromatic amine-containing methacrylates ....See Entry 72447

The influence of parameter nonuniformity on the two-dimensional Einstein relation in periodic and non-periodic semiconductor structures ...... See Entry 72486

Minority carrier diffusion lengths in liquid phase epitaxial InGaAsP and InGaAs ...... See Entry 72524

Electric and photoelectric investigations of β-nickel phthalocyanine thin films ...... See Entry 72525

Control of carrier concentration by stimulated emission in highly excited direct gap semiconductors ...... See Entry 72836

Optical properties of epitaxial $PbS_{1-x}Se_x$ films ...... See Entry 72881

Comparative investigation of the formation of an activating coating of photocathodes based on mono- and polycrystalline gallium arsenide ...... See Entry 72941

72.20M Galvanomagnetic and other magnetotransport effects

72426 Quantum oscillation of carrier concentation due to Fermi level pinning by doped indium impurities in $Pb_{1-x}Sn_xTe$. S.Takaoka, T.Itoga, K.Murase (Dept. of Phys., Osaka Univ., Toyonaka, Japan).
Solid State Commun. (USA), vol.46, no.4, p.287-90 (April 1983).
The Shubnikov-de Haas like oscillation and rapid increase of the carrier concentration above the quantum limit magnetic field (H_0) are observed in $Pb_{1-x}Sn_xTe$ doped with indium (x=0.33 and 0.35). Experimental results can be reproduced satisfactorily by the calculation based on the Fermi level pinning model due to In-impurities, where the authors take into account the level broadening (Γ) effect of the band structure. It is confirmed that the increasing rate of carrier concentration with respect to magnetic field above H_0 decreases with larger Γ. (18 refs.)

72427 Dependence of the Hall effect on the magnetic field in a model of an inhomogeneous narrow-gap semiconductor. R.V.Pomortsev, A.N.Mezentsev (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1420-1 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2196-9 (Dec. 1982). [received: May 1983]
The authors consider a simple model of an inhomogeneous semiconductor containing regions with n- and p-type conduction. The dimensions of the regions are such that the behavior of carriers can be described by quasiclassical expressions for the electrical conductivity tensors. Inside each region the electrical conductivity tensor is constant and, moreover, it assumes only one of the two values: σ^n for all the n-type regions and σ^p for all the p-type regions. The regions themselves are distributed at random relative to one another. (9 refs.)

A correlation of atomic and electrical measurements of Cr and residual donors in thermally processed semi-insulating GaAs ...... See Entry 72000

Electrical properties of Te diffused silicon ...... See Entry 72164

Anomalous quantum Hall effect: an incompressible quantum fluid with fractionally charged excitations ...... See Entry 72335

Localization and correlation effects in metals and semiconductors—experiment ...... See Entry 72341

Electrical properties of donors in gallium phosphide ...... See Entry 72345

Metastable donor states in Te-doped $Ga_{1-x}Al_xSb$ compounds ...... See Entry 72348

Energy spectrum of Sn and Ge impurity states in solid solutions based on lead chalcogenides ...... See Entry 72352

Critical behavior of the low-field Hall conductivity at a percolation threshold ...... See Entry 72368

Quantum correlations to conductivity and energy relaxation in InP and InSb ...... See Entry 72398

Investigation and analysis of the temperature dependence of the Hall effect in liquid tellurium ...... See Entry 72399

On *I-U* characteristics of semiconductor structures with inhomogeneous mobility profile ...... See Entry 72408

Hot electron conduction of PbTe and $Pb_{1-x}Sn_xTe$ ...... See Entry 72409

Interband recombination of nonequilibrium carriers in p-type $Cd_xHg_{1-x}Te$ ($x \approx 0.25$) ...... See Entry 72420

Theory of galvanomagnetic effects in supperlattices ...... See Entry 72489

Microstructure and electro-optical properties of evaporated indium-oxide films ...... See Entry 72522

Effects in the optical and electrical properties of CdS crystals from the accumulation of structural defects under laser irradiation ...... See Entry 72845

Electrical resistivity, magnetoresistance and microstructure of carbon-fiber/CVD-carbon composite ...... See Entry 73056

72.20N Thermomagnetic effects

72428 Nernst-Ettingshausen coefficient in quantizing magnetic fields in the case of scattering by impurities with an arbitrary radius of action. L.N.Vikhor, L.S.Drapak, S.L.Korolyuk (State Univ., Chernovtsy, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1443-4 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2229-31 (Dec. 1982). [received: May 1983]
The authors calculate the Nernst-Ettingshausen NE coefficient in quantizing magnetic fields for the scattering of carriers on impurities with an arbitrary radius of action. They consider the case in a degenerate semiconductor electron gas. (9 refs.)

72.20P Thermoelectric effects

72429 Influence of thermal annealing on thermoelectric properties of normal and neutron-doped silicon crystals. P.I.Baranskii, E.I.Vidalko, V.V.Savyak, V.P.Shapovalov (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1434-6 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2216-19 (Dec. 1982). [received: May 1983]
The authors have investigated the influence of high-temperature annealing and various cooling regimes on some thermoelectric properties of neutron-doped and normal (grown from the melt) silicon crystals. The drag piezothermoelectric power was measured at T=85K for neutron-doped and normal samples in the $X \parallel \nabla T \parallel [001]$ geometry. (6 refs.)

Electronic conductivity, Seebeck coefficient, and defect structure of $La_{1-x}Sr_xFeO_3$ (x=0.1, 0.25) ...... See Entry 72387

Ternary copper oxides with the rutile structure: the compounds $Ti_{1-x}Cu_{x/3}Nb_{2x/3}O_2$ ...... See Entry 72391

Electrical properties of sintered $EuTiO_3$-$EuNbO_3$ ...... See Entry 72392

Crystal structure of $(DPPP)(TCNQ)_5(H_2O)$ and electrical properties of the mixed valence TCNQ salts of diquaternised 1,3-bis(4-pyridyl)propane ...... See Entry 72394

Investigation and analysis of the temperature dependence of the Hall effect in liquid tellurium ...... See Entry 72399

Hot-electron thermo-EMF in silicon ...... See Entry 72500

Magnetic properties of the compound $HfFe_2Si_2$ ...... See Entry 72633

72.30 HIGH-FREQUENCY EFFECTS; PLASMA EFFECTS

72430 Spin polarization of electron-hole plasma in Mn-doped ZnTe. S.I.Gubarev, A.V.Komarov (Phys. Inst., Acad. of Sci., Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.28-30 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.446-8 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Nonequilibrium degenerate electron-hole plasma (EHP) in cubic ZnTe:Mn crystals has been investigated. The properties of spin polarization in such crystals are associated with the existence of a strong exchange interaction of free carriers ($S^e=1/2$, $S^h=3/2$) with 3d electrons in Mn^{2+} ions. (6 refs.)

72431 Distribution of relativistic electrons of a high current beam in a solid state target. V.I.Boiko, E.A.Gorbachev, V.V.Estigneev.
Fiz. Plazmy (USSR), vol.9, no.2, p.366-70 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
An investigation is reported into the penetration and interaction of a high-current electron beam with substances which form a solid-state plasma under the action of the beam. In the general case the problem can be defined as a self-consistent and nonstationary one, requiring the solution of a system of equations consisting of the kinetic equation for relativistic electrons, Maxwell's equation for the electromagnetic field and equations describing the change in the parameters of the medium under the action of the high-current electron beam. Diffusion of the magnetic field in the absorber is not taken into account here. Results obtained indicate that the electric and magnetic fields created by the high current beam alter the distribution of relativistic electrons in a solid state target considerably. (13 refs.) *A.G.C.*

72432 Density profile of the 3D one-component plasma near a hard insulating wall from density functional theory. A.Alastuey, J.J.Weis (Lab. de Phys. Theorique et Hautes Energies, Univ. de Paris Sud, Orsay, France).
J. Phys. C (GB), vol.16, no.13, p.2449-53 (10 May 1983).
A density functional theory recently proposed by Alastuey and Levesque (1982) is applied to the density profile of the three-dimensional one-component plasma near a hard insulating wall. The results are compared with Monte Carlo and HNC calculations in the range of coupling constants $10 \lesssim \Gamma_B \lesssim 30$. (18 refs.)

72433 Distribution of mesoplasma radiation in the direct bias voltage. Ya.K.Balodis, T.Ya.Puritis, A.Yu.Geske.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.54-61 (1983). In Russian.
Integral radiation intensity from separate areas of mesoplasma in the direct bias voltage is studied. Dimensions of the mesoplasma's area with diminished intensity of visible radiation narrow perpendicular to the n^+-p-junction and move into the direction of higher doping silicon while increasing mesoplasma's current density. As a result of the analysis it is suggested that ionization in mesoplasma usually takes place outside, the space charge of the *p-n*-junction and the area of ionization is closely connected with the mesoplasma light emitting areas. (4 refs.)

72434 Thermodynamic properties of equilibrium and non-equilibrium plasmas in GaP. H.Schweizer, A.Forchel, W.Schmid (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.318-20 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reports the first measurement of the phase diagram of electron-hole liquid (EHL) condensation for a polar compound semiconductor with indirect band structure. Above the critical point the authors observe an electron-hole plasma (EHP) with a density which increases with temperature. In contrast to previous results they find no evidence for a first-order Mott-transition of free excitons into this EHP. (12 refs.)

72435 The e-h plasma in direct-gap GaAlAs under 3-D confinement. M.Capizzi, A.Frova, F.Martelli, S.Modesti, L.G.Quagliano (Istituto di Fisica, Univ. di Roma, Rome, Italy), J.-L.Staehli, M.Guzzi, R.A.Logan, G.Chiaretti.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.333-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Uniformly excited e-h plasma in direct-gap $Ga_{1-x}Al_xAs$ under 3-D confinement has been measured by photoluminescence at 2K. A satisfactory fit to experiment in the whole range of densities investigated is given by a theoretical model with k-conservation and collision broadening, using a single value of density and temperature throughout the excited region. The fitted renormalized gap matches closely current theoretical values, independent of composition x. (17 refs.)

72436 Electron-hole plasma in direct gap semiconductors—a new non-equilibrium model. A.Forchel, H.Schweizer, H.Nather, K.M.Romanek, J.Fischer (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany), G.Mahler.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.336-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The formation of non-equilibrium electron-hole plasmas in direct gap semiconductors is studied using a phenomenological model for the plasma thermodiffusion. The theoretical results for the plasma density as a function of temperature and band structure are in good agreement with new experimental results from InP and with literature data from different III-V and II-VI compound semiconductors. Including the plasma diffusion in the calculation of lineshapes removes previously reported discrepancies between the experimental and theoretical binding energies. (10 refs.)

Proceedings of the 16th International Conference on the Physics of Semiconductors .... See Entry 69780

Second harmonic generation in centro-symmetric semiconductors .... See Entry 71183

Theoretical and experimental studies of the transition from the exciton to the plasma phase .... See Entry 72325

Amplification of two-dimensional plasma waves by a charged-particle beam .... See Entry 72338

Drag of electrons by a longitudinal electric wave and sign of the drag force .... See Entry 72419

Influence of nonlinear effects on the surface impedance of a conductor .... See Entry 72469

Hot-electron thermo-EMF in silicon .... See Entry 72500

Cyclotron resonance in a degenerate plasma of a semiconductor with a superlattice .... See Entry 72677

Control of carrier concentration by stimulated emission in highly excited direct gap semiconductors .... See Entry 72836

Dependence of the properties of a nonequilibrium degenerate electron-hole plasma on the energy of the exciting photons in ZnTe crystals .... See Entry 72868

72.40 PHOTOCONDUCTION AND PHOTOVOLTAIC EFFECTS; PHOTODIELECTRIC EFFECTS

72437 Photoconductivity enhancement by light trapping in rough amorphous silicon. T.Tiedje, B.Abeles, J.M.Cebulka, J.Pelz (Corporate Res. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.712-14 (15 April 1983).
The photoconductivity of amorphous silicon films is shown to be enhanced by a factor of 25 at long wavelengths when the material is deposited on a rough, reflecting substrate. In a solar cell, this light trapping effect would produce a 4.5-mA/cm^2 increase in the short circuit current. (8 refs.)

72438 Photovoltaically active p layers of amorphous silicon. B.W.Faughnan, J.J.Hanak (RCA Labs., Princeton, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.722-4 (15 April 1983).
Studies on amorphous silicon p-n diodes have shown that the p layers are photovoltaically active. J_{sc} of up to 3.4 mA/cm^2 and V_{oc} of 780 mV have been observed. Detailed quantum efficiency measurements were performed as a function of bias voltage, p-layer thickness, and boron doping. The data fit a simple depletion width model in which all photogenerated carriers created inside the depletion region are collected. An additional 'reverse' barrier depletion width is assumed at the interface between the front transparent oxide electrode and the p layer to explain the results. A 10-mm-thick p layer typically used in p-i-n cells could collect up to 1 mA/cm^2 if the electric field in the p layer is greater than 10^5 V/cm. (4 refs.)

72439 Photoconductive response of compensating impurities in photothermal ionization spectroscopy of high-purity silicon and germanium. L.S.Darken (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), S.A.Hyder.
Appl. Phys. Lett. (USA), vol.42, no.8, p.731-3 (15 April 1983).
In photothermal ionization spectroscopy both positive and negative photoconductivity responses have been reported from compensating centers neutralized by minority carriers generated by band-edge light. Here, the response of compensating impurities in both n-type and p-type high-purity ($|N_A$-$N_D| \approx 10^{10}$-10^{12} cm^{-3}) nuclear-detector-grade silicon and germanium is reported. Negative photoconductive responses from compensating impurities were observed only when the distance the photothermally generated majority carriers traveled before recapture by shallow levels was longer than the sample length (contact to contact). The authors propose that in high-purity semiconductors, such as used in this study, it is the contact configuration that is responsible for the apparent rapid recombination of minority carriers which causes negative minority-carrier photoconductivity. n^+nn^+ or p^+pp^+ structures allow multiple traversals through the sample by only majority carriers. The dependence of the band-edge light generated excess carrier density on applied electric field supports this mechanism. (12 refs.)

72440 Polarization-sensitive photovoltaic effect in germanium sulphide single crystals. L.K.Mladzhov (Central Lab. of Sun Energy & New Energy Sources, Bulgarian Acad. of Sci., Sofia, Bulgaria).
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.57-62 (1983).
The appearance of a photoelectromotive force in rhombic low-symmetry germanium sulphide single crystals has been studied for the first time. The photovoltaic effect was found to be highly sensitive to linear polarized excitation. The photoelectromotive force (FEMF) is shown to be a periodic function of the angle contended between the electric vector E of the exciting polarized light and the crystallographic axes a and b of the crystal. The spectral dependence of FEMF has been studied in the 1.2-2.6 eV excitation energy range at E normal and parallel to the axis a. The photovoltaic pleochroism spectral distribution is characterized by a sharp maximum at 1.72 eV; it changes sign in the region about 1.64 eV. The results obtained are of interest in designing high-sensitive photoreceivers for direct detection of linear polarized radiation. (8 refs.)

72441 Photoelectric properties of pelicular sandwich structures based on cadmium sulphoselenide. E.B.Kaganovich, Yu.N.Maksimenko, S.V.Svechnikov.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.19-23 (1982). In Russian.
The photoelectric parameters and characteristics of two types of sandwich structures (those based on CdSe deposited by thermal vaporisation and by condensation in a quasiclosed space in a vacuum and those based on CdS films deposited by sedimentation during centrifugal separation from a powdery material with a binder) are investigated. The dependences of the magnitude of the impedance and its multiplicity factor on the magnitude and frequency of the voltage applied and the illumination intensities are explained within the framework of their equivalent circuits. (5 refs.) *L.M.H.*

72442 Impulse response of photoconductors in transmission lines. D.H.Auston (Bell Labs., Murray Hill, NJ, USA).
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.639-48 (April 1983).
The response of high-speed photoconductors to picosecond optical pulses is analyzed by representing them as time-varying circuit elements in transmission lines. Expressions are derived for transmitted and reflected waves for photoconductors used both as pulse generators and sampling gates. These results are then used to determine the correlated response of pairs of photoconductors in different transmission line networks. The results provide a basis for estimating the limiting speed of response of this approach to very high-speed electronic measurements. (26 refs.)

72443 Methodology for calculating turn-off transient of photoconductive circuit elements in picosecond optoelectronics. B.Hwang, F.A.Lindholm (Dept. of Electrical Engng., Univ. of Florida, Gainesville, FL, USA), R.B.Hammond.
IEEE J. Quantum Electron. (USA), vol.QE-19, no.4, p.648-57 (April 1983).
A methodology for calculating the transient following sudden removal of photon or mass-particle excitation is developed for semiconductor devices in which high hole-electron recombination rates, rather than short transit times, yield picosecond response time. The name photoconductive circuit element (PCE) is suggested for these optoelectronic transducers. The device consists of a nearly intrinsic active region that contains extremely high concentrations of deep-level states acting as recombination centers. Regions of semiconductors highly doped with shallow donor or acceptor atoms connected to metallic contacts border this active region. In calculating the turnoff transient, criteria are set forth that define nearly ideal ohmic-contact systems and the quasi-neutrality regime of the intrinsic region. If these criteria are met, the turn-off transient becomes a problem in photoconductive decay. For incremental variations in the electron and hole quasi-Fermi voltages much less than the thermal voltage, two characteristic times, assigned to each recombination-center energy level describe electron-hole recombination. InP:Fe photoconductive circuit elements containing eight different Fe concentrations, excited by 780 and 600 nm laser-light pulses and 6 MeV electron pulses, showed a $(1/e)$-fall-time versus Fe-concentration in general accord with results calculated by the methodology. (21 refs.)

72444 Stability of semiconducting TiO$_2$ photoanodes. Fu-Tai Liou, C.Y.Yang (Dept. of Energy & Environment, Brookhaven Nat. Lab., Upton, NY, USA), S.N.Levine.
J. Electrochem. Soc. (USA), vol.130, no.4, p.893-5 (April 1983).
Reported are some striking aging effects observed with relatively high doped TiO$_2$ anodes which have been exposed in the dark to alkaline solutions for somewhat over 100 hr. No detailed explanation for the effects noted is available at this time. (10 refs.)

72445 Photovoltaic properties of thin polymer films. K.Yamashita, T.Suzuki, T.Hino (Dept. of Electrical & Electronic Engng., Tokyo Inst. of Technol., Tokyo, Japan).
J. Vac. Soc. Jpn. (Japan), vol.26, no.1, p.30-4 (1983). In Japanese.
Photovoltaic properties of thin films of PVK-TNF charge transfer complex have been investigated. Thin films of thickness between 10 and 500 nm were formed by the solution casting method. The film thickness can be reproductively controlled by the concentration of polymer solution. Photovoltaic properties were measured in a Au-(thin-film)-Al cell as a function of film thickness. Peaks of the photovoltaic action spectrum coincide with those of light absorption spectrum respectively. The photovoltaic conversion efficiency increases with reducing film thickness, until the efficiency becomes maximum value (about 0.01%) at the thickness of about 100 nm. (7 refs.)

72446 Photoconductive properties of TiO$_2$ powders. F.Kaneko, H.Itoh, M.Takeuchi, H.Nagasaka.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.61-7 (1982).
Hydrous titanium oxides were precipitated by adding NH$_4$OH to TiCl$_4$ and Ti(SO$_4$)$_2$ solutions, and by hydrolysis in water of Ti(OCH(CH$_3$)$_2$)$_4$. Some of hydrous titanium oxides were dissolved by oxalic acid and reprecipitated by adding NH$_4$OH. Titanium oxide powders were prepared from these hydrous titanium oxide by firing at 500 to 1000°C. Crystal structures of the sample powders were investigated by means of X-ray diffractometry. The photoconductive properties of TiO$_2$ powders depended on the starting materials, reaction temperature for hydrous titanium oxide and firing temperature of hydrous titanium oxide. The photosensitivity of TiO$_2$ powder prepared from hydrous titanium oxide precipitated at 10 to 12°C was larger than that of samples prepared from oxide precipitated at 75 to 80°C. The photosensitivity of all TiO$_2$ powders prepared from Ti(SO$_4$)$_2$ was small. On the other hand, the optimum firing temperature of hydrous titanium oxides was 700°C for all samples. The spectral response curve extended from 310 to 460 nm and showed two peaks in this region for the TiO$_2$ powder with high photosensitivity. (5 refs.)

72447 Photoconductivity and hole transport in polymers of aromatic amine-containing methacrylates. M.Stolka, D.M.Pai, D.S.Renfer, J.F.Yanus (Joseph C. Wilson Center for Technol., Xerox Corp., Rochester, NY, USA).
J. Polym. Sci. Polym. Chem. Ed. (USA), vol.21, no.4, p.969-83 (April 1983).
Substantial hole transport can be achieved in organic polymers simply by incorporating aromatic amine groups into the monomer. Hole mobilities similar to or greater than those in poly(N-vinyl-carbazole) (PVK) were measured in a series of high molecular weight arylamine-substituted polymethacrylates. The hole transport in these polymers is electric-field-dependent as in PVK, varying between E and E^2 within a range of 4×10^4-$\sim9\times10^5$ V/cm. The polymers also exhibit carrier generation in ultraviolet (UV) light in the range of absorption. Synthesis of the monomers, their polymerization, and the general properties of these polymers are discussed. (30 refs.)

72448 The determination of absorption coefficients from the photoresponse of silicon Schottky barriers. S.Mil'shtein, Y.Brada (Dept. of Phys., Ben-Gurion Univ., Beer-Sheva, Israel).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.194-6 (25 April 1983).
A novel approach to the measurement of the absorption coefficient was made through the use of differential photocurrents of Schottky barriers in order to eliminate the influence of unknown surface conditions. By varying the reverse bias on Schottky barriers created by semitransparent Au on Si wafers, the depth of the barrier layer was varied and the resulting photocurrents were used to evaluate the absorption coefficient of the substrate at room temperature. The results are in good agreement with values published in the recent literature. (9 refs.)

72449 Influence of the mobility threshold on the photoconductivity. L.P.Ginzburg (Electrical Engng. Inst. of Communications, Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1400-2 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2171-3 (Dec. 1982). [received: May 1983]
The author shows that there is experimental evidence confirming that for degrees of compensation $\ll 1$ then a mobility threshold exists in the impurity-band photoconductivity at liquid helium temperatures. (14 refs.)

72450 Model of long-term relaxation photoconductivity of GaN:Zn structures. Ya.D.Lebedev, M.D.Shagalov (Polytech. Inst., Vologda, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1428-9 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2207-8 (Dec. 1982). [received: May 1983]
The authors report a study of long-term processes, particularly of the kinetics of growth and decay of the photoconductivity. The experimental results were obtained in the case of excitation with impurity-absorbed light when a sample exhibited a considerable photosensitivity. The general nature of the growth and decay curves of the photoconductivity was the same also in the region of the fundamental absorption band. (4 refs.)

72451 Kinetic theory of the displacement photovoltaic effect in piezoelectrics. V.I.Belinicher, E.L.Ivchenko, B.I.Sturman (Inst. of Automation & Electrometry, Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.359-66 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.649-61 (Aug. 1982). [received: May 1983]
It is shown that, besides the mechanisms of the photovoltaic effect (PVE) that are connected with the appearance of asymmetry in the electron velocity distribution [V.I. Belinicher and B.I. Sturman, Sov. Phys. Usp. 23, 199 (1980); E.L. Ivchenko and G.E. Pikus, in: Problemy sovremennoi fiziki (Problems of Modern Physics), Nauka, Leningrad, 1980, p.275], there exist independent mechanisms stemming from the displacement of the electrons in R space when they undergo quantum transitions. This displacement PVE is determined by the contributions to the current of the off-diagonal—in the band numbers—density matrix elements. A consistent kinetic theory of the displacement PVE is constructed for band-band and impurity-band transitions. It is shown that the magnitudes of the displacements can be expressed in terms of the phases of the transition matrix elements. The displacement photocurrent is equal to the sum of the ionization, recombination, and scattering currents, which do not depend on the electron and hole mean free paths. The magnitude of the off-diagonal contribution to the current can be comparable to the magnitude of the diagonal contribution. (21 refs.)

72452 Microanalysis of candidate thin and thick film photovoltaic materials. P.E.Russell, C.R.Herrington (Solar Energy Res. Inst., Golden, CO, USA).
Scanning Electron Microsc. (USA), pt.3, p.1077-82 (1982).
Thin and thick films of materials such as CdTe, InP, Zn_3P_2, GaAs and $CuInSe_2$ represent candidate materials for low cost photovoltaic applications. The films typically exhibit a high degree of surface roughness when prepared by potentially low cost techniques. WDS and EDS analysis on an automated electron microprobe has been developed for compositional analysis of candidate films. The use of a defocused beam and low beam voltage greatly reduces the error caused by sample roughness when using standard ZAF analysis routines. Taking data from a large number of points, performing individual ZAF analysis and then averaging the results gives additional improvements in quantitative analysis. Errors due to surface roughness can easily be reduced to a few atomic percent. (7 refs.)

Metastable donor states in Te-doped $Ga_{1-x}Al_xSb$ compounds .... See Entry 72348

Experimental determination of the characteristics of deep centers in III-V crystals on the basis of a two-band model .... See Entry 72354

Reversible photoinduced modification of electron-capture cross section at localized states in *a*-Si:H .... See Entry 72355

Gap states in a-Si:H by photoconductivity and absorption .... See Entry 72356

Longitudinal diffusion of nonequilibrium carriers in thin semiconductors .... See Entry 72382

Diffusion length of holes in *n*-InP .... See Entry 72411

Characteristics of the current flow and of the photoelectric properties of *p-i-n* structures made of epitaxial GaAs:Cr .... See Entry 72478

Photosensitivity spectra of a nonideal *p*-Si-*n*-GaAs heterojunction .... See Entry 72488

Minority carrier diffusion lengths in liquid phase epitaxial InGaAsP and InGaAs .... See Entry 72524

Electric and photoelectric investigations of β-nickel phthalocyanine thin films .... See Entry 72525

SbSI and other ferroelectric $A^VB^{VI}C^{VII}$ materials .... See Entry 72739

Control of carrier concentration by stimulated emission in highly excited direct gap semiconductors .... See Entry 72836

Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect .... See Entry 72882

Annealing effects in a-Si:H thin films prepared by glow discharge method .... See Entry 73002

The growth of Cu_2S on polished or etched single crystal CdS substrates [for photovoltaic cells] .... See Entry 73004

The influence of the interface state on the properties of solar cell semiconductor electrodes .... See Entry 73434

Some problems of MIS photovoltaic cells with a dominating minority charge carrier flow .... See Entry 73435

The relation between performance and stability of Cd-chalcogenide/polysulfide photoelectrochemical cells. I. Model and the effect of photoetching .... See Entry 73465

72.50 ACOUSTOELECTRIC EFFECTS

72453 'Current-free' amplification of hypersound in a planar configuration. E.M.Epshtein.
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1411-12 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2185-7 (Dec. 1982). [received: May 1983]
The author considers 'current-free' amplification of sound in a planar configuration when a longitudinal electric field, a magnetic field, and the wave vector of sound are all in the same plane, and the sample is open-circuited in the direction of propagation of sound, i.e. the corresponding component of the current density **j** vanishes. They consider the case when the acoustic wavelength is short compared with the mean free path of electrons and with the Larmor radius, so that one can ignore the influence of the magnetic field on the form of the integral representing collisions of phonons with electrons. (6 refs.)

72454 Dislocation theory for long-term memory in stimulated electroacoustic-echo effect in powdered piezoelectrics. A.M.Kosevich, V.V.Bogoboyashchii (Physicotech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1759-64 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3110-19 (Oct. 1982). [received: April 1983]
A theory of the long-term memory is developed on the basis of a study of the motion of linear lattice defects (dislocations) under the influence of elastic and electric fields, whose behavior is described by a joint system of Maxwell's equations and the equations of the nonlinear theory of elasticity. It is shown that a periodic electric field incident on the crystal gives rise to elastic stresses whose average values over the period are sufficient to cause a noticeable redistribution of the dislocations. As a result, remanent elastic strains are created in the crystal and persist for a long time. It is found that the elastic fields of the readout pulse, which cause a shift in the natural frequency of the crystal, interact with the remanent stresses in such a way that echo signals are generated. (11 refs.)

72.55 MAGNETOACOUSTIC EFFECTS

72455 Giant quantum oscillations of sound absorption in a superlattice. G.M.Shmelev, Nguyen Hong Shon, G.I.Tsurkan (V.I. Lenin State Univ., Kishinev, USSR).
J. Phys. C (GB), vol.16, no.13, p.2587-90 (10 May 1983).
The authors demonstrate the possibility of oscillations of the electronic sound absorption in non-degenerate semiconductors with a superlattice placed in a magnetic field. The process is as follows. The Landau level is broadened so that its breadth equals the width of the lowest mini-band. Making the top of one Landau zone coincide with the bottom of another causes the resonant transition of electrons with phonon absorption to take place. This process causes large-amplitude oscillations of the absorption coefficient with changing magnetic field. (5 refs.)

'Current-free' amplification of hypersound in a planar configuration .... See Entry 72453

72.60 MIXED CONDUCTIVITY AND CONDUCTIVITY TRANSITIONS

72456 Electrical conductivity characteristics of ferric metavanadate. K.Tennakone, W.G.D.Dharmaratna (Dept. of Phys., Ruhuna Univ. Coll., Matara, Sri Lanka).
J. Phys. D (GB), vol.16, no.5, p.855-9 (14 May 1983).
The electrical conductivity characteristics of ferric metavanadate are studied. It is found that this material undergoes a conductivity transition at 168°C. (5 refs.)

Charge density wave transport in $(TaSe_4)_2I$ .... See Entry 72379

Stabilization under pressure of the metallic state in electrically conducting organic tetraselenotetracene salts $(TSeT)_2Br_xCl_{1-x}$ .... See Entry 72381

The effect of pressure to 140 kbar on the electrical properties of $CeCu_2Si_2$ .... See Entry 72403

Switching and negative capacitance in Al-$Ge_{15}Te_{81}Sb_2S_2$-Al devices .... See Entry 72516

72.70 NOISE PROCESSES AND PHENOMENA

72457 A fundamental noise limit for biased resistors at low temperatures. M.R.Arai (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.906-8 (15 May 1983).
A biased resistor at low temperature T is modelled by a degenerate Fermi gas whose electrons scatter from phonons in thermal equilibrium and impurities while moving in the presence of a finite electric field E. A nonperturbative solution of the Boltzmann equation valid for thin films yields a Fermi-like steady state distribution characterized by an effective temperature $T^*(>T)$. For large fields the energy scale (T^*) is set by the energy (eEl^*) absorbed in an inelastic mean free path ($l^* \propto T^{*-3/2}$). This yields T^* proportional to $E^{2/5}$. At low temperatures and frequencies the Johnson noise temperature is T^*, independent of the bath temperature for large fields. (9 refs.)

72.80 CONDUCTIVITY OF SPECIFIC SEMICONDUCTORS AND INSULATORS

(see also 81.40R Electrical and magnetic properties related to materials treatment)

Resolution of the conductivity dilemma in liquid solutions of alkali metals in alkali halides .... See Entry 72395

Photovoltaic properties of thin polymer films .... See Entry 72445

Preparation, electrical resistivity and its temperature dependence of RuO_2-polystyrene composite powder .... See Entry 73061

72.80C Elemental semiconductors

Effect of argon implantation on the activation of boron implanted in silicon .... See Entry 71986

Problem of behavior of oxygen in Si .... See Entry 72001

Electrical properties of Te diffused silicon .... See Entry 72164

Reversible photoinduced modification of electron-capture cross section at localized states in *a*-Si:H .... See Entry 72355

Gap states in a-Si:H by photoconductivity and absorption .... See Entry 72356

The resistivity inhomogeneity and the maximum possible mean resistivity of neutron-transmutation doped silicon .... See Entry 72389

The non-parabolicity of the n-Si conduction band caused by elastic deformation along the [111] direction .... See Entry 72396

Investigation and analysis of the temperature dependence of the Hall effect in liquid tellurium .... See Entry 72399

Carrier recombination and lifetime in highly doped silicon .... See Entry 72414

Minority carrier recombination in heavily-doped silicon .... See Entry 72415

Hole density and degree of compensation of synthetic *p*-type diamond .... See Entry 72422

Spin-dependent recombination on dislocation dangling bonds in silicon .... See Entry 72425

Influence of thermal annealing on thermoelectric properties of normal and neutron-doped silicon crystals .... See Entry 72429

Distribution of mesoplasma radiation in the direct bias voltage .... See Entry 72433

Photoconductivity enhancement by light trapping in rough amorphous silicon .... See Entry 72437

Photovoltaically active ρ layers of amorphous silicon .... See Entry 72438

Photoconductive response of compensating impurities in photothermal ionization spectroscopy of high-purity silicon and germanium .... See Entry 72439

The determination of absorption coefficients from the photo-response of silicon Schottky barriers .... See Entry 72448

About the transfer of the current of majority carriers at the absence of drift field when the avalanche local breakdown of the p-n junction develops ... See Entry 72485

Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect ... See Entry 72882

Recrystallization of amorphous and small grain size polycrystalline silicon ... See Entry 72998

Annealing effects in a-Si:H thin films prepared by glow discharge method ... See Entry 73002

Impurities in polycrystalline silicon solar cells ... See Entry 73454

72.80E III-V and II-VI semiconductors

A correlation of atomic and electrical measurements of Cr and residual donors in thermally processed semi-insulating GaAs ... See Entry 72000

The effect of a continuous etch on the growth rate and morphology of InP prepared by the vapour phase epitaxial-hydride method ... See Entry 72264

Characterisation of compound semiconductor epitaxial layers . See Entry 72267

Electrical properties of donors in gallium phosphide ... See Entry 72345

Metastable donor states in Te-doped $Ga_{1-x}Al_xSb$ compounds ... See Entry 72348

Experimental determination of the characteristics of deep centers in III-V crystals on the basis of a two-band model ... See Entry 72354

Proton and deuteron bombarded $Ga_{0.47}In_{0.53}As$ ... See Entry 72383

Quantum correlations to conductivity and energy relaxation in InP and InSb ... See Entry 72398

Behavior of silicon in indium antimonide ... See Entry 72401

Electron transport in InP at high electric fields ... See Entry 72404

Diffusion length of holes in *n*-InP ... See Entry 72411

Interband recombination of nonequilibrium carriers in p-type $Cd_xHg_{1-x}Te$ $(x\approx0.25)$ ... See Entry 72420

Increase in the minority-carrier lifetime in GaAs as a result of irradiation and heat treatment ... See Entry 72421

Photoelectric properties of pelicular sandwich structures based on cadmium sulphoselenide ... See Entry 72441

Methodology for calculating turn-off transient of photoconductive circuit elements in picosecond optoelectronics ... See Entry 72443

Model of long-term relaxation photoconductivity of GaN:Zn structures ... See Entry 72450

High mobility in liquid phase epitaxial InGaAsP free of composition modulations ... See Entry 72521

Minority carrier diffusion lengths in liquid phase epitaxial InGaAsP and InGaAs ... See Entry 72524

Effects in the optical and electrical properties of CdS crystals from the accumulation of structural defects under laser irradiation ... See Entry 72845

Nouvelles methodes de preparation de materiau semi-conducteur cellules solaires Cu_2S-CdS (New methods for the production of the solar cell semiconductor material Cu_2S-CdS) ... See Entry 73439

72.80G Transition-metal compounds

Electrical conductivity of single crystal nickel tungstate ... See Entry 72385

Electrical conduction in cobalt-phosphate glasses ... See Entry 72390

Ternary copper oxides with the rutile structure: the compounds $Ti_{1-x}Cu_{x/3}Nb_{2x/3}O_2$ ... See Entry 72391

Preparation and electrical conductivity of $Cr_2V_2WO_{10}$ and $Cr_2Nb_2WO_{10}$ with the rutile structure ... See Entry 72393

Electrical conductivity of amorphous V_2O_5 ... See Entry 72397

Electrical conductivity characteristics of ferric metavanadate . See Entry 72456

72.80J Other crystalline inorganic semiconductors

Energy spectrum of Sn and Ge impurity states in solid solutions based on lead chalcogenides ... See Entry 72352

Electronic conductivity, Seebeck coefficient, and defect structure of $La_{1-x}Sr_xFeO_3$ $(x=0.1, 0.25)$ ... See Entry 72387

Hot electron conduction of PbTe and $Pb_{1-x}Sn_xTe$ ... See Entry 72409

Negative temperature coefficient of the equilibrium carrier density in self-compensated β-SiC ... See Entry 72417

Quantum oscillation of carrier concentation due to Fermi level pinning by doped indium impurities in $Pb_{1-x}Sn_xTe$ ... See Entry 72426

Polarization-sensitive photovoltaic effect in germanium sulphide single crystals ... See Entry 72440

Stability of semiconducting TiO_2 photoanodes ... See Entry 72444

Microstructure and electro-optical properties of evaporated indium-oxide films ... See Entry 72522

SbSI and other ferroelectric $A^{V}B^{VI}C^{VII}$ materials ... See Entry 72739

Optical properties of epitaxial $PbS_{1-x}Se_x$ films ... See Entry 72881

Lattice disorder and electrical conductivity of flux-grown $Ca(WO_4)_x(MoO_4)_{1-x}$ crystals ... See Entry 72978

72.80L Organic semiconductors

Electrical conductivity of 2,4-dinitrosoresorcinol and its complexes ... See Entry 72388

Crystal structure of $(DPPP)(TCNQ)_5(H_2O)$ and electrical properties of the mixed valence TCNQ salts of diquaternised 1,3-bis(4-pyridyl)propane ... See Entry 72394

Anomalous transport properties in disordered organic layers ... See Entry 72523

Electric and photoelectric investigations of β-nickel phthalocyanine thin films . ... See Entry 72525

A new relationship of DC conductivity with loss modulus in PET ... See Entry 73120

72.80N Amorphous and glassy semiconductors

The effects of incorporating fluorine in amorphous germanium-silicon alloy films ... See Entry 72261

Comments on the theory of amorphous semiconductors ... See Entry 72295

Reversible photoinduced modification of electron-capture cross section at localized states in *a*-Si:H ... See Entry 72355

Gap states in a-Si:H by photoconductivity and absorption ... See Entry 72356

Electrical conduction in cobalt-phosphate glasses ... See Entry 72390

Electrical conductivity of amorphous V_2O_5 ... See Entry 72397

Photoconductivity enhancement by light trapping in rough amorphous silicon ... See Entry 72437

Photovoltaically active ρ layers of amorphous silicon ... See Entry 72438

Switching and negative capacitance in Al-$Ge_{15}Te_{81}Sb_2S_2$-Al devices ... See Entry 72516

Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect ... See Entry 72882

Annealing effects in a-Si:H thin films prepared by glow discharge method ... See Entry 73002

72.80P Liquid semiconductors

Investigation and analysis of the temperature dependence of the Hall effect in liquid tellurium ... See Entry 72399

72.90 OTHER TOPICS IN ELECTRONIC TRANSPORT IN CONDENSED MATTER

72458 Analytic expression of the Warburg impedance for a rotating disk electrode. B.Tribollet, J.Newman (Dept. of Chem. Engng., Univ. of California, Berkeley, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.822-4 (April 1983).
In the presence of the convective flow pattern of the rotating disk, the classical Warburg impedance is modified, particularly at low frequencies. The transformation of Scherson (1980) permits the alternating current impedance problem to be related to the transient flux-step or concentration-step behavior of the same system. Flux-step results are used to generate low and high frequency analytic expressions which overlap at intermediate frequencies. (16 refs.)

73.00 ELECTRONIC STRUCTURE AND ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS

ECOSS-5. Proceedings of the Fifth European Conference on Surface Science ... See Entry 69782

73.20 ELECTRONIC SURFACE STATES

(for emission and impact phenomena, see 79.)

72459 Electron structure of metal surfaces. S.N.Bezryadin, Yu.Kh.Vekilov, V.D.Verner, M.B.Samsonova.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.11-14 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1230-4 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors investigate the (001) and (111) surfaces of aluminum and sodium films by a method that utilizes the integral Fourier transformation. A surface state is found in aluminum film with surface (001), and resonant states are detected in films with surface (111); the electron structure of the surfaces is plotted. (17 refs.)

72460 On the nature of donor centers on the surface of an oxide cathode. A.M.Sokolov, B.P.Nikonov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.57-60 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1278-81 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
At present it is generally agreed that an oxide cathode (OC) is in a state of dynamic equilibrium in the process of operation, such that the composition of the surface of the oxide layer (OL) is the decisive factor in the emission process, while the processes occurring in the interior of the OL and in the surface layer maintain the stability of the emission properties of the surface. There is no information regarding the part played in formation of surface donor centers by various components of OL such as barium, strontium, calcium, and oxygen, although it is precisely a particular combination of these components in a system of oxide solid solutions that gives rise to a system with unique emission properties, i.e. an oxide cathode. The authors present an investigation of oxides of alkali-earth metals (AEM) and of (BaSrCa)O oxide cathodes on both neutral bases (platinum) and on active nickel bases with deposition of 0.1% calcium (NICA) in various phases of emission activity. (7 refs.)

72461 Physical interactions between molecules and supported catalysts. J.I.Gersten (Dept. of Phys., City Coll., City Univ. of New York, New York, NY, USA).
Isr. J. Chem. (Israel), vol.22, no.4, p.408-12 (1982).
Analytic expressions for the interaction potential of a molecule with a supported catalyst are obtained. Particular attention is focused on the region of the boundary line between the metal particle and the substrate. (5 refs.)

72462 The electrostatic potential above the 100 surface plane of a FCC ionic crystal with a continuous electron charge distribution. A.B.Ephraim, M.Folman (Dept. of Chem., Technion-Israel Inst. of Technol., Haifa, Israel).
Isr. J. Chem. (Israel), vol.22, no.4, p.413-18 (1982).
The electrostatic potential above the 100 surface plane of a FCC ionic crystal has been calculated using a point charge distribution for the positive nuclei and a continuous charge density distribution for electrons. The continuous electron charge distribution has been obtained from the known results of a

Fourier crystal structure analysis. The results for the electric field and its different gradients are compared with those obtained from the Lennard-Jones and Dent model (point charge distributions for both the positive and negative ions). The two models lead to significant differences of the electrostatic potentials and their derivatives. (7 refs.)

72463 Two-dimensional electrons in a magnetic field. III. Many-body effects. Y.Shiwa, A.Isihara (Dept. of Phys., State. Univ. of New York, Buffalo, NY, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4743-53 (15 April 1983).
A many-body theory is given to show that the magnetic properties of a two-dimensional electron system are dependent on the filling factor γ_0^{-1} defined as the ratio of the ideal Fermi energy against the field energy. Explicit results are obtained for absolute zero and large values of this factor. The internal energy is evaluated explicitly in consideration of the ideal, first-order exchange and ring contributions. The result converges for all r_s because for the ring contribution no small-momentum-transfer assmption is made and for low densities a rigorous analytical continuation is adopted. When plotted against γ_0^{-1}, the internal energy shows parabolic variations in a periodic way until it approaches the average kinetic energy for large γ_0^{-1}. The ideal susceptibility shows zigzag changes characteristic of absolute zero when it is plotted against γ_0^{-1}. It is zero at $\gamma_0^{-1}=2m+1$, where it jumps from $-2m$ to $2(m+1)$, m being an inverter. The Coulomb interaction suppresses the zigzag variations for small r_s and inverts the oscillating pattern at $r_s \sim 0.7$. The oscillations thereafter may be considered characteristic of a liquid state rather than a gaseous state as they are somewhat different from those for small r_s. The susceptibility is convergent for all r_s. (7 refs.)

72464 Surface states of metastable $(GaAs)_{1-x}Ge_{2x}$ alloys. A.C.Redfield, M.A.Bowen, K.E.Newman, J.D.Dow (Dept. of Phys., Univ. of Illinois, Urbana-Champaign, IL, USA).
Solid State Commun. (USA), vol.46, no.5, p.371-3 (May 1983).
The proposed order-disorder transition as x varies in metastable $(GaAs)_{1-x}Ge_{2x}$ alloys should be observable in photoemission experiments. There should be large 'kinks' in the (100) surface state energies as functions of x near the critical composition x_c. (9 refs.)

72465 Surface electronic structure of rutile-type semiconductors: $SnO_2(110)$ and $TiO_2(110)$. S.Munnix, M.Schmeits (Inst. de Phys., Univ. de Liege, Sart Tilman, Belgium).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.20-4 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The authors have investigated the electronic structure of the ideal (110) surfaces of the rutile structure compounds SnO_2 and TiO_2 using the scattering theoretic method. The results are presented in terms of surface bound states, surface resonances and wave vector resolved densities of states. For $SnO_2(110)$, the dominant features are two backbond states in the stomach gap of the main valence band and two Sn-s derived states in the lower conduction band region. For $TiO_2(110)$, they obtain no occupied surface states in the gap region, in agreement with UPS measurements on defectless $TiO_2(110)$ surfaces. The creation of the surface leads essentially to O-p resonances in the valence band region and Ti-d resonances in the conduction band region. (8 refs.)

72466 Band structure of an atom adsorbed on a surface; application to the He/Cu(113) system. J.R.Manson, G.Armand (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.681-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Presents a method of exactly calculating the band energies of an atom adsorbed on a surface based on Neumann iteration of the projected transition matrix equations. The band structure calculated for a model of He on a Cu(113) surface shows large shifts and band gaps and differs substantially from the nearly free particle model. Comparison with an approximate calculation shows that the contributions to the energy shifts due to continuum state transitions are nearly negligible except for the higher band levels. (9 refs.)

72467 Plasmon excitation in Al-Mg surfaces. P.Braun, M.Arias, H.Stori, F.P.Viehbock (Inst. fur Allgemeine Phys., Tech. Univ. Wien, Wien, Austria).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.714-18 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
When energetic electrons transit through solid surfaces, they lose energy in characteristic amounts. For the light metals, such as Al and Mg, collective oscillations of the electron plasma dominate over other loss mechanisms such as interband transitions. A commercial Auger spectrometer was used to analyze the surface composition and to measure the electron loss spectra of eight different samples. The electron primary energies for the electron loss spectra were 100 and 300 eV. Surface and volume plasmon energies are in good agreement with values calculated from the simple free electron model. Scribed samples, representing the bulk composition, show plasmon energies intermediate between the pure elements, with nearly linear dependence on the atomic composition. Sputtered samples exhibit a strongly altered surface composition due to preferential sputtering. Aluminum is enriched at the surface by a factor of 5. Plasmon energies observed on sputtered surfaces are generally higher, corresponding to the enrichment in aluminum. Taking into account the altered surface composition of the sputtered samples, the values of the plasmon energies fit fairly well to the values of the scribed samples. This indicates that no segregation of phases during sputtering takes place. (7 refs.)

72468 Electronic structure of the Si(111) reconstructed surface in the vacancy model. II. H.Nagayoshi (Dept. of Materials Phys., Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Surf. Sci. (Netherlands), vol.127, no.1, p.1-9 (April 1983).
For pt.I see ibid., vol.116, p.163 (1982). The electronic structure of a 2×2 superlattice of vacancies on the Si(111) surface is examined by the self-consistent pseudopotential method. The results, together with previous work on the $\sqrt{3} \times \sqrt{3}$ structure, show that there is a large dispersion in the surface state energy bands associated with the dangling bonds toward the vacancy. This fact suggests that the surface electronic structure in the vacancy model for the 7×7 reconstructed surface is sensitive to the arrangement of vacancies. Next the three-vacancy unit model proposed by Ino (1980) for the 7×7 surface is investigated in the parametrized tight-binding scheme with the parameter values determined from the fitting of energy levels of the periodic 2×2 system to the results of the self-consistent calculation. (10 refs.)

Proceedings of the XVIII All-Union Conference on Emission Electronics .... See Entry 69775

Adsorption and electron state of CO, NO, and O_2 on Pt and Ir: Investigation by photoelectron spectroscopy and thermodesorption ....See Entry 72216

Low-energy surface exciton impurity states ....See Entry 72328

Anomalous quantum Hall effect: an incompressible quantum fluid with fractionally charged excitations ....See Entry 72335

Longitudinal diffusion of nonequilibrium carriers in thin semiconductors ....See Entry 72382

Formation of electron structure of (111) Si-Au boundary ....See Entry 72495

The effects of deep levels in GaAs MESFETs ....See Entry 72496

Study of Ag/Si(111) submonolayer interface. I. Electronic structure by angle-resolved UPS ....See Entry 72499

Characteristics of formation and annealing of defects in silicon near the Si-SiO_2 interface during implantation of Ar^+ ions ....See Entry 72512

Elementary surface excitations in insulators and metals. Methods of spectral examination ....See Entry 72878

Binding energy of electrons of surface atoms of oxidized 3d transition metals, obtained by the method of appearance-potential spectroscopy .See Entry 72889

AES and EELS study of hydrogen adsorption, oxygen adsorption and sulphur segregation on a clean titanium surface ....See Entry 72895

Energy structure of surface region of tungsten single crystal as expressed in the secondary-electron spectrum ....See Entry 72902

Scattering of slow electrons by a surface and its relationship to the energy structure ....See Entry 72904

Wavevector-resolved electron-energy-loss spectroscopy on the dangling-bond states of Si(111)-(2×1) ....See Entry 72905

Interaction of helium with a metal surface ....See Entry 72918

Photostimulated exoemission from some organic compounds ...See Entry 72943

A study of the core level electrons in iron and its three oxides by means of X-ray photoelectron spectroscopy ....See Entry 72947

Calculation of spin-polarized threshold photoemission from the Ni(001), Ni(111), and Ni(110) surfaces ....See Entry 72954

Adsorbate-induced umklapp processes in photoemission from Cl on Cu ....See Entry 72957

Photoemission from low-dimensional systems ....See Entry 72958

Symmetry effects in the electron spectroscopy of metals with an ordered adsorbate overlayer ....See Entry 72960

Photoemission study of oxygen adsorbed on coldly deposited silver films ....See Entry 72961

73.25 SURFACE CONDUCTIVITY

72469 Influence of nonlinear effects on the surface impedance of a conductor. A.P.Kopasov, A.G.Skoryukov (Gor'kii Physicotech. Res. Inst., Gor'kii, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.334-41 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.607-19 (Aug. 1982). [received: May 1983]
The influence of the nonlinear effects on the surface impedance of a conductor located in a constant magnetic field **H** oriented parallel to its surface is investigated in the case when the skin effect has the anomalous character. It is assumed that the time taken by an electron to traverse the skin layer is much shorter than the mean free time and the period of the electromagnetic wave. The reflection of the electrons by the surface is considered to be nearly diffuse scattering. The corrections to the surface impedance that stem from the following nonlinear currents are estimated: the current that is cubic in the field of the fundamental wave (the first harmonic), the current produced by the fields of the first and second harmonics together, and the current produced by the electric field of the first harmonic and the magnetic field of the rectified radioelectric current. Normally, all the three corrections are of the same order of magnitude. In certain cases the influence of the homogeneous magnetic field produced in the interior of the sample by the radio-electric current predominates. The nonlinearity can be significant even when the magnetic field of the wave is much weaker than the field **H**. (17 refs.)

72470 Conduction of two-dimensional systems with dielectric inclusions. L.V.Gorodzha, Yu.P.Emets, S.I.Stril'ko.
Tekh. Elektrodin. (USSR), no.2, p.3-6 (March-April 1983). In Russian.
An examination is made of the problem of change in effective conductivity of periodically-nonuniform media during change in the concentration of dielectric inclusions. Analytically and with the aid of physical modelling it is shown that near the metal-dielectric transition, the logarithmic variation in dependency is associated with the presence of 'tapers' in the form of inclusions. The differential conductivity of two-dimensional heterogeneous media at the critical point assumes an infinite value. (2 refs.) *A.J.B.*

73.30 SURFACE DOUBLE LAYERS, SCHOTTKY BARRIERS, AND WORK FUNCTIONS

72471 Modification of Schottky barriers in silicon by reactive ion etching with NF_3. S.Ashok, T.P.Chow, B.J.Baliga (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.687-9 (15 April 1983).
Reactive ion etching of silicon with NF_3 gas has been found to alter the silicon surface such that the Schottky barrier height is systematically changed with ion energy. The energetic ions introduce a net positive surface charge which increases the barrier height on *p*-Si and decreases it on *n*-Si. The Schottky barrier modification is found to be a function of ion energy as well as gas plasma used. (17 refs.)

72472 Electron work function and donor-acceptor properties of nonideal or adparticle-covered metal surfaces. L.A.Rudnitskii (State Res. & Design Inst. for Nitrogen Industry & for Products of Organic Synthesis, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.20-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1240-6 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Local variations of the surface potential discontinuity of nonideal or monocrystalline but adparticle-covered surfaces are described by the method of localized orbits of surface atoms, each of which is assigned a local value of the orbital electronegativity x equal to the derivative of the energy of the orbital with respect to this charge. (15 refs.)

72473 Effect of point defects of metal surface on the electron work function. A.I.Reznik, N.V.Rudenko (Kazakh State Univ., Kazakh, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.61-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.,* vol.46, no.7, p.1282-7 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors offer a quantitative examination of the effect of surface point defects (intrinsic adatoms and surface vacancies) on the work function of a metal. They also determine the magnitudes of the dipole moments localized on surface defects. (9 refs.)

72474 Temperature dependence of work function of principal faces of molybdenum. D.Kh.Azizova, N.A.Gorbatyi, A.F.Chumachenko (Lenin Tashkent State Univ., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.71-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.,* vol.46, no.7, p.1292-4 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors determine the temperature coefficient of the work function (TCWF) of the principal (110), (100) and (111) faces of Mo single crystal in the temperature range 1400-2000K. They have employed the procedure for determining the temperature shift of the break point of the delay curves that was developed by Shelton (1957). (4 refs.)

72475 Structure of potential near a nonuniform surface and the anomalous Schottky effect. S.G.Dmitriev (Inst. of Radio Engng. & Electronics, Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.98-101 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.,* vol.46, no.7, p.1320-3 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The author considers the surface potential structure and the anomalous Schottky effect in the case of practical importance of a 'spotty' surface with low concentration of 'spots' $R \gg \rho_0$, where R is the mean distance between spots and ρ_0 is their radius, but with a greatly reduced WF: $\Delta\phi \gg kT/e$, whre k is Boltzmann's constant and T is the temperature. (7 refs.)

72476 On the extraction of surface barrier potentials from threshold effects in LEED: saturation on Cu(001) revisited. G.Gaubert, R.Baudoing, Y.Gauthier (Groupe d'Etude des Surfaces, Univ. Sci. et Medicale de Grenoble, Grenoble, France), J.C.Le Bosse, J.Lopez.
J. Phys. C (GB), vol.16, no.13, p.2625-33 (10 May 1983).
The authors give a critical discussion of the extraction of the surface barrier potentials from LEED threshold effects as introduced by Dietz, McRae and Campbell (1980) for Cu(001). They show that their approximation, together with experimental and theoretical procedure, introduce an effective phase for the total-internal-reflection coefficient at the barrier from which the correct barrier shape cannot be extracted. Without the trick of a discontinuous barrier shape, the authors' correct analysis gives a better description than the empirical analysis. There remains, however, some discrepancy and the extraction of the Cu(001) barrier shape still needs both more experimental data and more theoretical studies for which the authors have specified the LEED framework. (13 refs.)

Proceedings of the XVIII All-Union Conference on Emission Electronics .... See Entry 69775

Scanning tunneling microscopy .... See Entry 72197

Adsorption and electroadsorption of oxygen on {111} and {113} faces of monocrystalline germanium .... See Entry 72217

Adsorption of lithium on the surface of germanium single crystal .... See Entry 72218

Interaction of hydrogen with a palladium (110) surface .... See Entry 72237

The interaction of CO with Al(111) at room temperature .... See Entry 72240

Coadsorption of water and ions on Cu(110): models for the double layer .... See Entry 72242

Interaction of O_2 with low index faces of α-CuZn .... See Entry 72248

A note on work function of metal-insulator system .... See Entry 72494

On the dielectric properties of semiconducting materials as obtained from impedance measurements on Schottky barriers .... See Entry 72732

Quantum size effect in electron transmission through Cu and Ag films on W(110) .... See Entry 72903

Interaction between thin films of barium and epitaxial crystals of strontium oxide .... See Entry 72935

Mechanism of escape of photoelectrons from photocathodes with negative electron affinity .... See Entry 72940

73.40 INTERFACES

72477 Size effect on contact resistance and device scaling. S.S.Cohen, G.Gildenblat, D.M.Brown (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.978-80 (April 1983).
The authors have measured the size effect on the contact resistance (R_c) to shallow junctions in silicon utilizing two different metallization systems. $R_c(W)$, where W stands for the contact widths, is found to display a nonquadratic dependence. Thus, the experimental observations show that the commonly used device scaling theory which assumes that contact impedance increases inversely with the square of the scaling factor is incorrect. (9 refs.)

72478 Characteristics of the current flow and of the photoelectric properties of *p-i-n* structures made of epitaxial GaAs:Cr. M.S.Saidov, B.Sadaev, V.V.Nikitin, A.S.Saidov, G.N.Kovardakova (S.V. Starodubtsev Physicotech. Inst., Acad. of Sci., Tashkent, Uzbek SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1398-400 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR),* vol.16, no.12, p.2167-70 (Dec. 1982). [received: May 1983]
The authors report the results of an investigation of epitaxial p-i-n structures made of GaAs:Cr and exhibiting S-type current-voltage characteristics. Special features of these structures were a 'high' current responsivity and the deformation of the spectral characteristics under forward bias conditions, as well as external control (by optical excitation) of the turnover voltage and of the minimum. The structure bases were grown specially by the method of liquid epitaxy with controlled compensation of the residual donors by deep chromium acceptor levels. (19 refs.)

Electrical measurements on n^+-GaAs-undoped $Ga_{0.6}Al_{0.4}As$-n-GaAs capacitors .... See Entry 72482

Azimuthal X-ray photoelectron diffraction from adsorbate core levels .... See Entry 72964

73.40B Static electrification

72479 The role of nonresonant tunnelling in contact electrification. J.Lowell (Joint Lab. of Phys. & Electrical Engng., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.141-4
Tunnelling to insulator states whose energy is higher than the metal Fermi level may occur during separation of the contacting surfaces of a metal and an insulator. However, the tunnelling probability for states significantly higher than E_F is too low for this process to be important in contact electrification. (2 refs.)

73.40G Tunnelling: general

(see also 74.50 in superconductors)

72480 Quantum theory of tunnelling. W.E.Hagston (Dept. of Phys., Univ. of Hull, Hull, England).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K85-9 (1 April 1983).
Recently the authors have treated various aspects of tunnelling in terms of the density matrix approach (1981, 1982). It is clear from the latter that in a formalism based on the Schrodinger equation the junction itself is not given a proper dynamical description. In order to appreciate the possible implications this could have, the authors consider the classic one-dimensional problem of a free particle of energy E_i and mass m, tunnelling through a rectangular barrier of height V_o and width d situated at the origin. The description of the barrier in terms of V_o alone is incomplete from the density matrix viewpoint, but carries with it the implicit assumption that the barrier is in contact with a large (technically infinite) energy source. As a result the energy of the tunnelling particle could be changed due to fluctuations in the barrier region. (3 refs.)

73.40J Metal-to-metal contacts

Quantum size effect in electron transmission through Cu and Ag films on W(110) .... See Entry 72903

73.40L Semiconductor-to-semiconductor contacts, p-n junctions, and heterojunctions

72481 Temperature dependence of interface recombination and radiative recombination in (Al, Ga)As heterostructures. G.W.'t Hooft, C.van Opdorp (Philips Res. Labs., Eindhoven, Netherlands).
Appl. Phys. Lett. (USA), vol.42, no.9, p.813-15 (1 May 1983).
From measurements of the quantum efficiency of $Al_{0.12}Ga_{0.88}As$-$Al_{0.47}Ga_{0.53}As$ double heterostructures the effective nonradiative carrier lifetime in the active region and at its interfaces is determined. From the dependence of this lifetime on active layer thickness a value for the interface recombination velocity s is obtained. For a particular sample grown by liquid phase epitaxy s turned out to be 1050 cm/s at 300K; between 110 and 360K the interface recombination velocity is proportional to $\exp(-E_a/kT)$ with an activation energy E_a of 27 meV. In the analysis the radiative coefficient B is taken to be proportional to $T^{-1.5}$, as theory predicts when a k-selection rule holds. This behaviour of B was verified experimentally with temperature-dependent minority-carrier lifetime measurements. (13 refs.)

72482 Electrical measurements on n^+-GaAs-undoped $Ga_{0.6}Al_{0.4}As$-n-GaAs capacitors. P.M.Solomon, T.W.Hickmott (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), H.Morkoc, R.Fischer.
Appl. Phys. Lett. (USA), vol.42, no.9, p.821-3 (1 May 1983).
Current versus voltage (*I-V*) and capacitance versus voltage (*C-V*) characteristics have been measured for n^+-GaAs-undoped $Ga_{0.6}Al_{0.4}As$-GaAs capacitors over a temperature range of 80-350K. At low temperatures the structure behaves like a semiconductor-insulator-semiconductor diode with interface barrier heights of 0.38 and 0.40 eV for the bottom and top interfaces, respectively. The *I-V* curves exhibit a rectifying behavior due to the formation of a substrate depletion layer, and the *C-V* curves show the formation of the depletion layer under reverse bias as well as an accumulation layer containing $>10^{12}$ electrons/cm^2, in forward bias. The *C-V* curves agree closely with standard theory for SIS structures assuming Fermi-Dirac statistics for electrons in the accumulation layer, within an unaccounted-for voltage shift of 0.16 V. (12 refs.)

72483 Investigation into nature of low-voltage breakdown of silicon p-n junctions. O.S.Frolov, S.P.Fabrikov, V.I.Palamarchuk.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.48-51 (1982). In Russian.
The nature of the over-currents in silicon planar n^+-p junctions is investigated. By studying n^+-p junctions with a controlling gate it is possible to separate the junction currents and the currents in the MOS structure. The basic mechanism for the generation of over-currents is shown to be the thermal generation of charge carriers in local regions of the silicon. The activation energy of this process is several times smaller than the halfwidth of the forbidden zone of the silicon. The local regions of increased thermal generation are located along the perimeter of the junction and, in smaller numbers, in the MOS structure of the controlling electrode but there are hardly any in the main body of the junction. The experimental data are analysed from the point of view of the distribution through a silicon plate of rapidly-diffusing impurities and the precipitation of the impurities in the silicon surface defects. (3 refs.) *L.M.H.*

72484 High-resolution mapping of p-n junctions by computer processed EBIC signals. H.K.Schink, H.Rehme (Forschungslab., Siemens AG, Munchen, Germany).
Electron. Lett. (GB), vol.19, no.10, p.385-5 (12 May 1983).
An SEM experimental set-up is described which uses, an electron beam induced current (EBIC) technique to measure two-dimensional potential and doping distributions of p-n junctions. Computer processing is introduced to increase resolution in EBIC measurements and make the method applicable to integrated circuits. (5 refs.)

72485 About the transfer of the current of majority carriers at the absence of drift field when the avalanche local breakdown of the p-n junction develops. B.A.Krasyuk, E.E.Pakhomov, V.N.Strizhevskii.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.115-19 (1983). In Russian.
It is shown that in VHF planar silicon transistors in the quasi-neutral vicinity of the region of local avalanche breakdown of the *p-n* junction pairs of majority carriers (by electric charge) may be formed so that one carrier has a positive and the other a negative effective mass. Such pairs flow without

scattering along the *p-n* junctions in the quasi-neutral base, so that it is possible to describe the superfluid flow of these pairs at room temperature. (7 refs.)

72486 The influence of parameter nonuniformity on the two-dimensional Einstein relation in periodic and non-periodic semiconductor structures. D.Tjapkin, V.Milanovic (Inst. of Phys., Univ. of Belgrade, Belgrade, Yugoslavia).
Phys. Status Solidi b (Germany), vol.116, no.2, p.653-8 (1 April 1983).
Taking into account the fact that the effective mass of carriers is spatial dependent, the expression for the Einstein relation (the diffusion coefficient to mobility ratio) are derived for the two-dimensional electron gas. The derived expressions are general and do not assume exclusively the parabolic dependence of the carrier energy on the wave vector, as well as the case of the quantum limit. The numerical results are given for GaAs-Al$_x$Ga$_{1-x}$As superlattice structure assuming that the dependence of the potential energy is rectangular. The maximum and the minimum are found for D/μ versus N_s which could be explained as a consequence of the spatial dependence of effective mass. (8 refs.)

72487 Microscopic investigations of semiconductor interfaces. G.Margaritondo (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Solid-State Electron. (GB), vol.26, no.6, p.499-513 (June 1983).
The author reviews the results obtained in recent years by applying surface-sensitive experimental techniques to the study of metal-semiconductor and semiconductor-semiconductor interfaces. The review starts with a short discussion of the most widely used experimental probes. Then the initial impact of this new approach on the old theoretical concepts about semiconductor interfaces is discussed. A presentation of selected results follows, including the detection of interface states, the formulation of the defect model, the discovery of chemical trends in the interface parameters and the recent progress in understanding heterojunction discontinuities. The review is concluded by a discussion of the open problems and of the most likely future developments in this field. (84 refs.)

72488 Photosensitivity spectra of a nonideal *p*-Si-*n*-GaAs heterojunction. A.G.Denisov, G.S.Dordzhin, Yu.G.Sadof'ev, L.V.Sharonova, A.Ya.Shik, Yu.V.Shmartsev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1386-90 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2152-7 (Dec. 1982). [received: May 1983]
An investigation was made of the spectral dependences of the photoresponse of *p*-Si-*n*-GaAs heterojunctions prepared by the molecular beam epitaxy method. It was found that the form of these spectral dependences was a function of the parameters of the heterojunction structure and of the illumination conditions. In the case of structures with low-resistivity GaAs films the photoresponse spectrum was a wide band and it was not very sensitive to the illumination conditions. In the case of films of higher resistivity the spectrum had a sharp peak at $\hbar\omega \approx 1.1$-1.2 eV of relative amplitude which increased rapidly as the illuminated spot moved away from the contact. This peak was of the same origin as the usual short-wavelength fall of the photoconductivity of a semiconductor and it was associated with the diffusion of nonequilibrium carriers along a nonideal heterojunction interface with a high concentration of recombination centers. A rigorous quantitative theory of the photoresponse of a nonideal heterojunction was developed and compared with the experimental results. (13 refs.)

72489 Theory of galvanomagnetic effects in supperlattices. V.M.Genkin, E.S.Potapenko (Inst. of Appl. Phys., Acad. of Sci., Gorki, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1441-3 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2225-8 (Dec. 1982). [received: May 1983]
The authors present a theory of the galvanomagnetic effects in semiconductor superlattices. They consider an asymmetric superlattice in crossed electric and magnetic fields, and assume that H lies in the plane of the conducting layers, whereas the field E is normal to the layers (parallel to the superlattice axis). (7 refs.)

72490 Amplification and reversal of a soliton electric current in a superlattice by an external magnetic field. E.M.Epshtein.
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1445 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2231-3 (Dec. 1982). [received: May 1983]
The nonlinearity of the electron properties of a semiconductor superlattice enables propagation of electromagnetic solitons. The author shows that this effect may be amplified and its sign may be reversed by the application of an external magnetic field prependicular to the superlattice axis. They consider solitons traveling at right-angles to the superlattice axis (i.e. along the layers forming the superlattice), so that the electric field of a soliton is directed along and the magnetic field across the superlattice axis. They assume that the x axis is parallel to the electric field, the y axis is parallel to the magnetic field, and the z axis is parallel to the direction of propagation of a soliton. (4 refs.)

72491 Peculiarities of the current transmission in degenerate semiconductor-semiconductor heterojunctions. S.Yu.Pavelets, T.M.Svanidze, V.P.Tarasenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.581-5 (April 1983). In Russian.
Studies peculiarities of the direct current in degenerate semiconductor-semiconductor *p-n*-heterojunctions. Strong degeneration of copper sulphide permits a considerable increase in the diffusion potential of Cu$_{1.8}$S-CdS(CdSe) heterojunctions and for GaAs and InP this results in formation of inverse *p-n* junctions in them. In all investigated heterojunctions recombination-tunnel currents dominate whose character is dependent on the environmental conditions. The current transmission-semiconnection contact is featured by an interconnection of the carrier recombination and generation in the space charge region with tunnelling. (12 refs.)

Distribution of mesoplasma radiation in the direct bias voltage .... See Entry 72433

Photovoltaically active ρ layers of amorphous silicon .... See Entry 72438

Giant quantum oscillations of sound absorption in a superlattice .... See Entry 72455

Hot-electron thermo-EMF in silicon .... See Entry 72500

Minority carrier diffusion lengths in liquid phase epitaxial InGaAsP and InGaAs .... See Entry 72524

Cyclotron resonance in a degenerate plasma of a semiconductor with a superlattice .... See Entry 72677

Spin effects in p$^+$-i-n$^+$ a-Si:H cells; photovoltaic detected magnetic resonance (PDMR) .... See Entry 72698

Electroabsorption by Stark effect on room-temperature excitons in GaAs/GaAlAs multiple quantum well structures .... See Entry 72769

Diffraction properties of the classical superlattice of nonequilibrium carriers in a small modulation-amplitude semiconductor .... See Entry 72826

Recrystallization of amorphous and small grain size polycrystalline silicon .... See Entry 72998

The influence of the interface state on the properties of solar cell semiconductor electrodes .... See Entry 73434

Nouvelles methodes de preparation de materiau semi-conducteur cellules solaires Cu$_2$S-CdS (New methods for the production of the solar cell semiconductor material Cu$_2$S-CdS) .... See Entry 73439

73.40M Semiconductor-electrolyte contacts

72492 Effects of the Helmholtz layer capacitance on the potential distribution at semiconductor/electrolyte interface and the linearity of the Mott-Schottky plot. K.Uosaki, H.Kita (Dept. of Chem., Faculty of Sci., Hokkaido Univ., Sapporo, Japan).
J. Electrochem. Soc. (USA), vol.130, no.4, p.895-7 (April 1983).
The authors examine the effects of the Helmholtz layer capacitance on the bandedge movement and the linearity of the relation between $1/C^2$ and the applied voltage when no surface states are present by the calculation of the potential dependence of the Helmholtz layer capacitance and the potential change in the Helmholtz layer without many approximations. (8 refs.)

Study of InSb-based EOS and MOS structures .... See Entry 72504

Electrochemical methods of forming DS structures and electro-physical properties of electrolyte-dielectric-semiconductor systems .... See Entry 72507

On the dielectric properties of semiconducting materials as obtained from impedance measurements on Schottky barriers .... See Entry 72732

73.40N Metal-nonmetal contacts

72493 Relation between current-voltage characteristics and interface states at metal-semiconductor interfaces. C.Barret (Inst. d'Electronique Fondamentale, Univ. Paris-Sud, Orsay, France), P.Muret.
Appl. Phys. Lett. (USA), vol.42, no.10, p.890-2 (15 May 1983).
In the case of metal-covalent semiconductor interfaces, the 'pinning' of the metal Fermi level was attributed to large densities of interface states by Bardeen, 35 years ago. These interface states are usually thought to be in equilibrium with the metal. But capacitance measurements show unambiguously the existence of states in equilibrium with the semicondcutor, even for cleaved contacts. Freeouf argued recently that this kind of states would influence *I-V* characteristics. Here, some examples of such a correlation between interface states spectra and *I-V* nonidealities are presented for Au-InP and Au-Si contacts. (14 refs.)

72494 A note on work function of metal-insulator system. K.F.Wojciechowski (Inst. of Experimental Phys., Univ. of Wroclaw, Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.575-8 (April 1983).
The work function ψ of a metal-insulator system is calculated for a simple model of the system, in which the metal is replaced by jellium and the insulator by a continuum with a static dielectric constant ϵ. The gradient expansion of the kinetic, exchange and correlation contributions to the work function is taken into account. The calculated work functions for different metal-insulator systems have a minimum at the value $\epsilon \sim 2$, contrary to previous calculations which neglect gradient expansion and give the minimum of ψ at $\epsilon \sim 8$. (10 refs.)

72495 Formation of electron structure of (111) Si-Au boundary. V.K.Adamchuk, S.I.Fedoseenko, A.M.Shikin (Leningrad State Univ., Leningrad, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.105-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1328-31 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Presents some results of a comparative study of the initial phases of formation of (111) Si-Au (with gold deposited onto a pure (111) surface of Si) and (111) Si/C-Au (with gold deposited onto a carbon-passivated silicon surface) interphase boundaries, by the methods of Auger electron spectroscopy (AES) and characteristic-loss spectroscopy (CLS). (9 refs.)

72496 The effects of deep levels in GaAs MESFETs. A.Zylbersztejn (Div. Composants Microondes, Thomson-CSF, Orsay, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.44-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electrical characteristics of a GaAs MESFET are shown to be variously affected by deep levels, depending on their location in the gap and where they are in the device. An appropriate variation of the DLTS technique can be used to characterize deep levels in a MESFET. Measurements performend at emission time constants down to 0.6 ns have permitted a quantitative study of microwave noise due to electron traps in the channel. A spurious backgating effect in GaAs integrated circuits is due to hole traps on the substrate side of the active layer-substrate interface. The free surface of GaAs MESFETs is usually depleted due to the presence of surface states. Their charge state can be modified by lateral carrier transport on the GaAs surface, which affects the device electrical performances. (34 refs.)

72497 Characterization of the interface states at Al-GaAs Schottky barriers with a thin interface layer. J.R.Morante, A.Lousa, J.E.Carceller, J.L.Morenza (Dept. d'Electricitat i Electronica, Univ. de Barcelona, Barcelona, Spain).
Solid-State Electron. (GB), vol.26, no.6, p.537-8 (June 1983).
The interface states density in GaAs Schottky diodes with a thin interface layer is found to be the origin of the capacitance values deviation with respect to the values deduced from the Mott-Schottky law. The dependence of this deviation versus the frequency and the forward applied bias is justified on the basis of a quasi-constant energy distribution of the interface states. (7 refs.)

72498 Schottky barrier height variation with metallurgical reactions in aluminum-titanium-gallium arsenide contacts. Y.Wada, K.Chino (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Solid-State Electron. (GB), vol.26, no.6, p.559-64 (June 1983).
The behaviour of Al/Ti/*n*-GaAs Schottky contacts under heat treatment at around 400°C have been studied for their application to GaAs MESFETs. Barrier heights have been determined using both *I-V* and *C-V* measurements as a function of heat treatment time. Reaction products due to heat treatment have been studied by X-ray diffraction and Auger electron spectroscopy. The Al/Ti/*n*-GaAs Schottky contacts barrier height shows an '*N*'-shaped variation in response to heat treatment time. A marked reduction in barrier height follows a slight increase at the initial annealing stage. The barrier height then takes a minimum value. The slight increase in barrier height at the initial

stage in the heat treatment is brought about by a Ti and GaAs reaction. The marked barrier height reduction is closely correlated to formation of the compound Al_3Ti. The increase in barrier height observed after the reduction can be explained in terms of GaAlAs formation at the metal-semiconductor interface. This seems to indicate that heat treatment is essential for application of Al/Ti/*n*-GaAs Schottky contacts to practical devices. (13 refs.)

72499 Study of Ag/Si(111) submonolayer interface. I. Electronic structure by angle-resolved UPS. T.Yokotsuka, S.Kono, S.Suzuki, T.Sagawa (Dept. of Phys., Faculty of Sci., Tohoku Univ., Sendai, Japan).
Surf. Sci. (Netherlands), vol.127, no.1, p.35-47 (April 1983).
Angle-resolved ultraviolet photoelectron spectra have been measured for well defined Ag/Si(111) submonolayer interfaces of (1) Si(111)($\sqrt{3}\times\sqrt{3}$)R30°-Ag, (2) 'Si(111)(6×1)-Ag', and (3) Ag/Si(111) as deposited at room temperature. Non-dispersive and very narrow (FWHM~0.4-0.5 eV) Ag 4d derived peaks are found at 5.6 and 6.5 eV below the Fermi level for surface (1) and at 5.3 and 6.0 eV for surface (2). Dispersions of sp 'binding' states in the energy range between E_F and Ag 4d states have been precisely determined for surface (1). Electronic structures similar to those of the Ag(111) surface, including the surface state near E_F, have been observed for surface (3). (21 refs.)

72500 Hot-electron thermo-EMF in silicon. S.P.Ashmontas, L.L.Vingyalis, L.E.Subachyus (Inst. of Semiconductor Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1361-4 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2110-15 (Dec. 1982). [received: May 1983]
The field and carrier-density dependences of the contact potential U_c were determined for a contact between a metal and silicon with an n-n^+ junction subjected to 3-cm microwave radiation. It was found that on reduction in the electron density in the *n*-type region the value of U_c/E_m^2 increased both at T_0=300K and at T_0=80K (E_m is the microwave field amplitude). Phenomenological equations for the current and heat balance in the warm-electron range were used to calculate the carrier-density dependence of U_c/E_m^2. It was found that at T_0=300K the rise of E_c/E_m^2on reduction in *n* was mainly due to an increase in the size of the active region of the n-n^+ junction, where a strong microwave electric field was established, and also due to an increase in the contribution of the microwave signal rectification. At T_0=80K the main contribution to the increase in U_c/E_m^2 on reduction in *n* was due to an increase in the size of the active region of the n-n^+ junction as well as due to an increase in the mobility and phenomenological energy relaxation time of electrons. (15 refs.)

72501 Surface charge generation on the metal-semiconductor interface. E.V.Buzaneva, V.I.Strikha, G.E.Chaika.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.575-81 (April 1983). In Russian.
A thermodynamic calculation is presented for the concentration of intrinsic and metal-induced defects on the semiconductor surface and on the metal-semiconductor interface. The calculations performed permit explaining a series of experimental dependences which have not been explained satisfactorily so far. (12 refs.)

Modification of Schottky barriers in silicon by reactive ion etching with NF_3 .... See Entry 72471

Microscopic investigations of semiconductor interfaces .... See Entry 72487

Test of short range effects in surface enhanced Raman spectroscopy: an elastic tunnelling study of pyridine-metal interfaces .... See Entry 72515

The CV product of etched aluminium anode foil .... See Entry 72520

On the dielectric properties of semiconducting materials as obtained from impedance measurements on Schottky barriers .... See Entry 72732

Angular scan spectrum of a surface plasma excitation on a Schottky diode .... See Entry 72880

Determination of quantum yield of metal particles to semiconductor in the SnI_2-Ag system .... See Entry 73353

73.40Q Metal-insulator-semiconductor structures
(inc. semiconductor-to-insulator)

72502 Gate-width dependence of radiation-induced interface traps in metal/SiO_2/Si devices. M.R.Chin (Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA), T.P.Ma.
Appl. Phys. Lett. (USA), vol.42, no.10, p.883-4 (15 May 1983).
The density of radiation-induced interface traps in a post-metal-annealed (PMA) Al-gate metal-oxide-semiconductor (metal/SiO_2/Si) depends strongly on the linewidth of the metal gate over a wide range (1-750 μm) of linewidths studied, although there is no discernible dependence prior to the irradiation. The dependence is such that the narrower the linewidth, the fewer the radiation-induced interface traps. Such dependence has been generally observed for both *p* and *n*-type Si samples, for oxides grown in dry O_2 or steam at temperatures over a wide range (900-10000°C), and for PMA treatment either in dry N_2 or in forming gas (10% H_2+90% N_2). The results can be qualitatively explained by a model based on the gate linewidth dependence of the SiO_2/Si interfacial stress prior to irradiation, which affects the radiation sensitivity in accordance with the strained bond model. (28 refs.)

72503 Influence of characteristic sizes of inhomogeneities on C-V dependence of MOS structures. A.I.Shkrebtii, A.V.Sachenko, O.V.Snitko.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.3-8 (1982). In Russian.
A method is proposed for calculating the capacitance-voltage dependences of MOS structures taking into account inhomogeneities of the following types: the semiconductor-dielectric interface relief; a charge nonuniformly incorporated into the dielectric and a nonuniformity in the volumetric doping level. The distribution of the electrostatic potential, electrons and holes in the surface region of the surface charge of the semiconductor is found in a low-signal amplitude-based approximation of the inhomogeneities. The part played by the magnitude of the characteristic size of the inhomogeneity in the capacitance-voltage characteristics is analysed. Inhomogeneities with a characteristic size less than or of the order of the effective screening length are found to cause a rise in the capacitance and an increase in the slope of the capacitance-voltage characteristics whereas inhomogeneities with a characteristic size considerably greater than the effective screening length produce a reduction in the slope of the capacitance-voltage characteristics. (4 refs.) *L.M.H.*

72504 Study of InSb-based EOS and MOS structures. O.V.Romanov, S.G.Sazonov, N.V.Motaleva, M.A.Sokolov.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.32-6 (1982). In Russian.
The complex field effect in electrolytes is used to demonstrate the feasibility of effective control of the parameters of a growing dielectric and the dielectric-semiconductor boundary, formed during anode oxidation. The different factors in the growth of the dielectric and in the subsequent processing of the DS system based on InSb are studied as well as the MOS structures formed from them. The influence of a whole series of different parameters involved in the formation of the DS system based on InSb characterises this process as the process of the formation of a complex multiple-component heterogeneous system, the quality of which is determined by the variations in the stoichiometric composition of the anodic oxide at the interface with the semiconductor. (5 refs.) *L.M.H.*

72505 Determining surface state spectrum from measurements of steepness of transfer characteristics of MOS transistor at high and low frequencies. Yu.S.Zharkikh, S.V.Lysochenko.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.36-45 (1982). In Russian.
A method is proposed for determining the density of the surface states overloaded during inversion bending of the zones on the surface of the semiconductor in metal-oxide-semiconductor (MOS) structures. The method is based on measuring the steepness of the transfer characteristics of a transistor at high and low frequencies. The possibilities of the method are analysed. The influence of inhomogeneities on the measurement results is discussed and an experimental investigation is made into the SS spectra in silicon MOS structures. The influence of γ-irradiation on the SS density at the edge of the forbidden zone is studied. No specially-designed test structures are required for the application of the method, which will clearly be extremely useful in the processing of new MOS structure technology. (9 refs.) *L.M.H.*

72506 Influence of irradiation temperature on radiative processes in MOS structures. V.I.Girii, S.I.Kornyushin, V.I.Shakhovtsov, L.G.Shchegoleva.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.78-81 (1982). In Russian.
The influence of gamma irradiation at temperatures ranging from 77 to 300K on the basic parameters of MOS structures—the charge in the dielectric, the surface state density and the effective charge-carrier mobility in the inversion channels μ_s is examined. Irradiation at 77K is shown to lead to the incorporation into the SiO_2 film of an additional positive charge without any change in the surface state density and to a rise in μ_s. These effects disappear when the structures are heated to room temperature. Physical mechanisms describing the experimental results obtained are proposed. (9 refs.) *L.M.H.*

72507 Electrochemical methods of forming DS structures and electrophysical properties of electrolyte-dielectric-semiconductor systems. P.P.Konorov.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.81-92 (1982). In Russian.
A survey is given of methods of forming dielectric layers on the surface of semiconductors by means of electrochemical oxidation and also of methods of achieving a directional change in the properties of dielectric-semiconductor (DS) structures by polarising them in electrolytes. The specific peculiarities of the electrolyte-dielectric-semiconductor system, which are at the root of the electrochemical oxidation and directional change in the properties of the DS structures, are described. The mechanisms for these processes are considered and the characteristics of DS structures produced electrochemically are presented. Particular attention is paid to DS structures based on silicon and semiconductors of the A^{III}-B^V group. (93 refs.) *L.M.H.*

72508 Electron beam induced damage in poly-Si gate MOS structures and its effect on long-term stability. M.Shimaya, N.Shiono, O.Nakajima, C.Hashimoto, Y.Sakakibara (Musashino Electrical Communication Lab., NTT Public Corp., Musashino-shi, Tokyo, Japan).
J. Electrochem. Soc. (USA), vol.130, no.4, p.945-50 (April 1983).
Repeated electron beam irradiation and annealing processes are shown to enhance radiation damage in the gate SiO_2, compared to only one irradiation and annealing cycle. Repeated irradiation with 20 keV electrons causes an introduction of more positive charge, neutral traps, and interface traps. Neutral trap density gradually increases with increasing repeated cycles, even after 700°C annealing in dry N_2, though these traps are removed completely by only one cycle. Positively charged and neutral traps are determined by avalanche hot-electron injection, and interface traps at the SiO_2-Si interface are determined by quasistatic C-V measurements. Long-term stability for electron beam irradiated MOS capacitors has been examined through positive and negative bias-temperature (BT) stress aging. Devices annealed at 450° and 700°C result in faster and larger V_{FB} shifts and interface trap generation under BT stress than those for devices annealed at 1000°C. Around 1000°C annealing is found necessary to completely remove structural defects in the oxides induced by ionizing radiation and to assure good long-term stability for MOS devices fabricated by electron beam lithography. (23 refs.)

72509 The properties of ZnSe MIS structure. H.Ozaki, M.Furukoshi.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.77-82 (1982). In Japanese.
An insulating layer of Al_2O_3 is deposited on ZnSe substrate by electron beam evaporation, and MIS structure of Au-Al_2O_3-ZnSe fabricated. The properties of the MIS structure are investigated by photoluminescence, electroluminescence and current-voltage characteristics. Under low forward-bias, the MIS device shows blue (2.67 eV) and orange (2.0 eV) electroluminescence at room temperature. (16 refs.)

72510 Accumulation and discharging of the hole charge in oxide layers of MIS structures. E.V.Anufriev, V.A.Gurtov (Petrozavodsk State Univ., Petrozavodsk, USSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.107-11 (16 March 1983).
Charge accumulation of non-equilibrium holes induced by X-ray irradiation is studied in silicon oxide layers of MIS structures. Thermal silicon dioxides obtained by oxidation in dry oxygen using chlorine technique as well as an anodic silicon dioxide are used as gate dielectrics. In all cases accumulation of approximately the same number of positively charged centers occurred after an X-ray exposure. Activation energy of isothermal annealing process is estimated as (0.2 to 0.5) eV. (11 refs.)

72511 Influence of backside argon implantation on the Si-SiO_2 interface. J.Dziesiaty (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany), F.-G.Kirscht, M.Mai, K.-R.Sprung.
Phys. Status Solidi a (Germany), vol.76, no.2, p.K105-8 (16 April 1983).
Investigates whether a backside argon implantation shows an influence on the defect density and the generation lifetime of minority carriers near the surface of the water after more than one high-temperature step. (8 refs.)

72512 Characteristics of formation and annealing of defects in silicon near the Si-SiO_2 interface during implantation of Ar^+ions. G.N.Galkin, R.U.Abbasova, E.A.Bobrova, V.S.Vavilov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1390-3 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2158-61 (Dec. 1982). [received: May 1983]
The method of low-frequency capacitance voltage characteristics of metal-insulator-semiconductor structures was used to study defects in silicon created by the implantation of Ar^+ ions in the vicinity of the Si-SiO_2 interface (dose

range 3×10^{10}-10^{12} ions/cm^2), which was followed by annealing at temperatures from room to 800°C. spectra of the density of the surface states of Si-SiO$_2$ structures were used to find the energy levels of defects at $E_c-0.28$, $E_c-0.40$, $E_v+0.44$, $E_v+0.36$, and $E_v+0.26$ eV, which were observed earlier after the implantation of Si$^+$ ions in an Si-SiO$_2$ structure. The thermal stability and the numbers of some of these defects differed for the implantation of Ar$^+$and Si$^+$. A characteristic defect formed as a result of implantation of Ar$^+$ had an energy level near the middle of the band gap, observed earlier after annealing at 500 and 700°C; this defect was found between 300 and 700°C. An analysis was made of the possible nature of defects formed as a result of implantation of Ar$^+$ions. (7 refs.)

72513 Luminescence of metal-tunnel-thin insulator-n-Si-p$^+$-Si systems. B.A.Malakhov (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1406-7 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2178-80 (Dec. 1982). [received: May 1983]
Luminescence was observed for a metal-tunnel-thin insulator-n-Si-p$^+$-Si system. The emission of luminescence can be explained by the recombination of electrons and holes at the semiconductor-insulator interface where a p-type inversion layer forms in the low-resistance state. When the voltage drop across the insulator is sufficiently high, the tunneling of electrons from the metal to the direct silicon band (point Γ_{15}) takes place and this is followed by radiative recombination. A similar situation may be realized in a metal-tunnel-thin insulator-p$^+$-Si system. Systems of this kind also emitted luminescence when a negative voltage in excess of 4 V was applied to the metal. No luminescence was emitted when a positive bias voltage was applied to the metal electrode. Moreover, luminescence was not observed in the case of a metal-tunnel-thin insulator-n$^+$-Si system. (3 refs.)

Proceedings of the 16th International Conference on the Physics of Semiconductors .... See Entry 69780

The effect of implantation of phosphorus into sputtered MoSi$_2$ thin films .... See Entry 72258

Parallel-processing with surface plasmons, a new strategy for converting the broad solar spectrum .... See Entry 73450

73.40R Metal-insulator-metal structures

72514 Electrical conduction and switching mechanism in Bi$_2$O$_3$ thin film diodes. Young-Kwon Sung, Nam-Ki Min, Ju-Ik Lee.
Trans. Korean Inst. Electr. Eng., vol.31, no.12, p.180-7 (1982). In Korean.
The electrical properties of metal-Bi$_2$O$_3$-metal diodes have been investigated. The DC current-voltage characteristic is ohmic at low voltage, followed by a square law region which suggests a space charge limited current, finally shows current-controlled negative resistance (CCNR). The occurrence CCNR is explained by the mechanism for setting up space charge which would result in a field redistribution and lead to the increased generation, injection or multiplication of carriers. The AC current-voltage characteristics are different from the DC I-V characteristics, and it doesn't appear the space charge effect vividly. Especially switching phenomena are observed in Ag-Bi$_2$O$_3$-Ag diodes and its behavior may be explained by Ag filamentary model. (15 refs.)

72515 Test of short range effects in surface enhanced Raman spectroscopy: an elastic tunnelling study of pyridine-metal interfaces. J.L.Tomlin, D.G.Walmsley, R.J.Turner, N.M.D.Brown (School of Phys. Sci., New Univ. of Ulster, Coleraine, N Ireland).
Surf. Sci. (Netherlands), vol.127, no.2, p.331-46 (April 1983).
The elastic tunnel current versus bias over the range ±1 V in junction of the type Al-I(X)-M where M=Pb, Ag, Cu or Au and X is 2-, 3- or 4-pyridinecarboxaldehyde has been used to determine parameters which describe the barrier in each. Little variation attributable to the different dopants is observed but there are substantial effects attributable to the top metal M in both clean and doped junctions. It is suggested that electron densities of states are responsible. The potential step between dopant and metal M decreases in the sequence Au:Pb:Ag. Evidence is collated from a number of sources to suggest that hydroxyl dipole layers influence the metal-organic interface potential step both in aqueous-solution-doped tunnel junctions and in SERS systems. (35 refs.)

Hot-electron picture of light emission from tunnel junctions ....See Entry 72871

73.40S Metal-semiconductor-metal structures

72516 Switching and negative capacitance in Al-Ge$_{15}$Te$_{81}$Sb$_2$S$_2$-Al devices. G.S.Nadkarni, N.Sankarraman, S.Radharkrishnan (Dept. of Phys., Inst. of Sci. Bombay, India).
J. Phys. D (GB), vol.16, no.5, p.897-908 (14 May 1983).
A theory to explain the switching behaviour and variation of the capacitance with temperature and voltage, is proposed for vacuum evaporated metal-glass-metal devices. It is also shown that the observed capacitance of the device could be negative under voltage bias conditions. It is proposed that the voltage V_{th} at which the device changes from the off state to the on state and the transition voltage V_{cn} at which the capacitance of the device becomes negative should be related to the glass transition temperature T_g. A study of Al-Ge$_{15}$Te$_{81}$Sb$_2$-Al devices reveals that the experimental results are in concurrence with the theoretical predictions. (9 refs.)

73.60 ELECTRONIC PROPERTIES OF THIN FILMS

73.60D Metallic thin films

72517 The frequency response of the effective resistance of thin palladium and manganese films. M.A.Angadi (Dept. of Phys., Univ. of the West Indies, St. Augustine, Trinidad), S.M.Shivaprasad.
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.207-9 (May 1983).
The authors' study shows the validity of the model proposed by A.A. Hirsch and S. Bazian (1964) for very thin Mn and Pd films. Though this property is strictly valid only for discontinuous films (as in Mn), it is also found to explain the phenomena in semicontinuous films (as in Pd), the simultaneous presence of different conduction processes in thin films is thus indicated. (12 refs.)

72518 Dependence of the magnetoresistance on dispersion properties of Permalloy films with allowance for the angular spatial dispersion of the anisotropy. Yu.V.Kornev, T.V.Borodina (N.E. Bauman Higher Tech. Coll., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.472-8 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The published theory of the magnetoresistance of uniaxial films and a statistical approach are used to obtain an analytic expression for the dependence of a quantity representing the magnetoresistance on the angles of planar and spatial dispersion of the magnetic anisotropy axis, which is supported well by the experimental results on Permalloy films. This dependence may be used as the physical basis of a contactless method for the fabrication of bubble-domain memories. The method involves the use of ferromagnetic resonance and a spectrometer is suggested for this purpose. (8 refs.) *A.T.*

72519 Characteristics of the Hall effect in two-layer iron and cobalt films. I.Ya.Kudryashova, V.S.Cherkashin (Buryat Pedagogical Inst., Ulan-Ude, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.491-5 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An experimental investigation was made of the Hall effect in two-layer iron-cobalt films. The two layers were evaporated on one another or were separated by an insulating spacer. Their thicknesses were very different. A comparison of the results of measurements of the Hall e.m.f. in the case of two- and one-layer films established the degree of influence of the individual components of the conductivity tensor on the anomalous Hall coefficient, the participation of the 3d electrons in the conductivity of iron and cobalt and the sign of their polarization, and the electron coupling between the layers. (5 refs.) *A.T.*

72520 The CV product of etched aluminium anode foil. H.J.de Wit, C.Crevecoeur (Philips Res. Labs., Eindhoven, Netherlands).
J. Electrochem. Soc. (USA), vol.130, no.4, p.770-6 (April 1983).
Deals with the analysis of tunnel structures in etched aluminium foil for electrolytic capacitors. The dependence of the capacitance of such foil on anodization voltage and on frequency was measured. Electron microscopy data were also used. The product of series capacitance C_s and anodization voltage U_f shows a characteristic decrease with U_f. This behaviour is first analyzed with the model in which it is attributed to the closing of tunnels during anodization. This model, however, leads to irremediable inconsistencies and has to be abandoned. It is proposed instead that the main cause of the decrease of $C_sU_f \sim U_f$ is the fact that the oxide layers of neighboring tunnels grow against each other during anodization. Results of anodization-stripping-anodization experiments are contrary to the former and in accordance with the latter model. (5 refs.)

Structure and electrical properties of amorphous Ni-P thin films [thin film resistors] .... See Entry 72280

Segregation phenomena in thin NiCr layers [thin film resistors] .... See Entry 72281

Electron microscopic and AES studies on thin layers of NiCr [thin film resistors] .... See Entry 72282

Importance of electron-phonon processes in the inelastic lifetime of conduction electrons .... See Entry 72377

73.60F Semiconductor films

72521 High mobility in liquid phase epitaxial InGaAsP free of composition modulations. M.Quillec, J.L.Benchimol, S.Slempkes, H.Launois (CNET, Bagneux, France).
Appl. Phys. Lett. (USA), vol.42, no.10, p.886-7 (15 May 1983).
$In_xGa_{1-x}As_yP_{1-y}$ epilayers lattice matched to InP were grown from the liquid phase at temperatures far above the commonly used temperature range. The goal was to get off the unstable region corresponding to compositions emitting in the wavelength range of 1.2 μm$<\lambda<$1.5 μm at 650°C. $In_{0.71}Ga_{0.29}As_{0.65}P_{0.35}$ (λ=1.35 μm) layers thus grown have the highest electron Hall mobilities ever obtained in this material: $\mu_{300K}=7000$ cm^2/Vs and $\mu_{77K}=23200$ cm^2/Vs for $N_d-N_A=8.10^{14}$ cm^{-3}. The authors suggest that a contribution to mobility limitation might be related to the composition modulations present in epilayers grown in the usual temperature range. (10 refs.)

72522 Microstructure and electro-optical properties of evaporated indium-oxide films. Z.Ovadyahu, B.Ovryn, H.W.Kraner (Brookhaven Nat. Lab., Upton, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.917-21 (April 1983).
The microstructures and electro-optical properties of thermally evaporated indium-oxide films are given and discussed. It is shown that highly transparent and conducting films can be prepared at relatively low (~150°C) substrate temperatures, with and without doping by tin. Results of stoichiometry measurements in conjunction with the Hall effect and crystal structure data suggest the existence of indium atoms with different valences in these films. This implies that the conduction mechanism in this material may be more complicated than hitherto assumed. (17 refs.)

72523 Anomalous transport properties in disordered organic layers. B.Ziolkowska-Pawlak, W.Mycielski, A.Lipinski (Inst. of Phys., Tech. Univ. of Lodz, Lodz, Poland).
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.215-19 (May 1983).
The results of time-of-flight experiments for two different organic compounds, copper phthalocyanine and tetracene layers are presented. These materials were investigated in the form of vacuum evaporated layers in which, as is known, transport phenomena are more complicated in comparison with those in monocrystals. The current-time profile observed for both materials was highly dispersive as judged by the phenomenological theory of stochastic hopping or multiple-trapping processes. The differences between theoretical prediction and experimental data are demonstrated, first of all, in the field dependence of the disorder parameters α_1 and α_2 for the initial and final parts of the log i versus log t plots, respectively. The results are compared with the experimental data for other materials, as well as with the results of numerical computations given by other authors. (12 refs.)

72524 Minority carrier diffusion lengths in liquid phase epitaxial InGaAsP and InGaAs. M.M.Tashima, L.W.Cook, G.E.Stillman (Materials Res. Lab., Univ. of Illinois, Urbana, IL, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.831-46 (July 1982). [received: Nov. 1982]
Minority carrier diffusion lengths were determined for InGaAsP and InGaAs layers grown by liquid phase epitaxy on (100) InP substrates by measuring the variation of the short circuit photocurrent as a focused laser beam was scanned along a beveled p-n junction. The effect of lattice-mismatch on the hole diffusion length (L_p) for n-type unintentionally doped InGaAsP layers (λ_g=1.15 μm) was investigated for mismatch values from −0.25% to

+0.31%, with the longest diffusion length occurring when the epitaxial layer was lattice-matched to the substrate. As the amount of mismatch increased, L_p decreased. Electron diffusion lengths, L_n, were determined for lattice-matched quaternary and ternary layers grown from Zn doped melts over a wide range of hole concentrations. At the lowest hole concentrations, the electron diffusion lengths were 3.5 and 2.5 μm for the quaternary and ternary, respectively. As the hole concentration increases, L_n decreased and at the highest concentration, L_n was 0.13 μm for InGaAsP and 0.83 μm for InGaAs. (16 refs.)

72525 Electric and photoelectric investigations of β-nickel phthalocyanine thin films. T.G.Abdel-Malik, A.A.Aly, A.M.Abdeen, H.M.El-Labany (Phys. Dept., Univ. of El-Minia, El-Minia, Egypt).
Phys. Status Solidi a (Germany), vol.76, no.2, p.651-9 (16 April 1983).
Electric and photoelectric measurements of β-nickel phthalocyanine films are quantitatively explained by the existence of an exponential trap distribution. An analysis of the results enables the determination of the electron mobility, density of states, total trap density, and the characteristic temperature of the trap distribution. (24 refs.)

The effects of incorporating fluorine in amorphous germanium-silicon alloy films .... See Entry 72261

Vapor phase epitaxial growth of ZnSe films .... See Entry 72263

The effect of a continuous etch on the growth rate and morphology of InP prepared by the vapour phase epitaxial-hydride method .... See Entry 72264

Characterisation of compound semiconductor epitaxial layers . See Entry 72267

Longitudinal diffusion of nonequilibrium carriers in thin semiconductors .... See Entry 72382

Hot electron conduction of PbTe and $Pb_{1-x}Sn_xTe$ .... See Entry 72409

Diffusion length of holes in *n*-InP .... See Entry 72411

Special features of photoluminescence of GaAs films produced by molecular-beam epitaxy .... See Entry 72848

Optical properties of epitaxial $PbS_{1-x}Se_x$ films .... See Entry 72881

Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect .... See Entry 72882

Photoemission and photoabsorption of amorphous Si films ...... See Entry 72967

Annealing effects in a-Si:H thin films prepared by glow discharge method .... See Entry 73002

Depot de couches polycristallines de silicium sur un substrat conducteur a partir de la phase liquide (Deposition of polycrystalline Si films on conducting substrates from the liquid phase) .... See Entry 73016

Nouvelles methodes de preparation de materiau semi-conducteur cellules solaires Cu_2S-CdS (New methods for the production of the solar cell semiconductor material Cu_2S-CdS) .... See Entry 73439

73.60H Insulating thin films

72526 Influence of powerful electrical fields on conductivity of silicon nitride films. V.V.Bulavinov, Yu.A.Tarantov, A.P.Baraban.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.28-32 (1982). In Russian.
The change occurring in the electrophysical characteristics of silicon nitride films during the degradation of silicon-silicon nitride structures is investigated. An increase is noted in the conductivity and density of the surface states at the internal boundary of the dielectric, indicating an increase in the density of the localised states in the centre of the forbidden zone of the dielectric. The results are interpreted within the framework of a model of tunable amphoteric centre formed by a ruptured silicon bond on the surface of a silicon cluster inside silicon nitride. (11 refs.) *L.M.H.*

72527 Variations of trap states and dangling bonds in CVD Si_3N_4 layer on Si substrate by NH_3/SiH_4 ratio. S.Fujita, H.Toyoshima, M.Nishihara, A.Sasaki (Dept. of Electrical Engng., Kyoto Univ., Kyoto, Japan).
J. Electron. Mater. (USA), vol.11, no.4, p.795-812 (July 1982). [received: Nov. 1982]
This study is concerned with deep trap densities and energy levels in CVD Si_3N_4 layer deposited on Si substrates at 700°C with various gas flow ratios NH_3/SiH_4. As the ratio NH_3/SiH_4 increases from 10 to 1000, the trap density decreases from 8×10^{19} to 2×10^{19} cm^{-3}, and energetic distribution of trap states becomes lower and/or electron emission probability from trap states becomes less. The results are discussed in terms of chemical and optical propertiers of Si_3N_4 film revealed by infrared absorption, Auger electron spectroscopy, and ellipsometry. It is shown that (i) Si dangling bonds create deep trap states and (ii) O and H atoms act as terminators to decrease trap density. (27 refs.)

Anomalous transport properties in disordered organic layers ... See Entry 72523

Cathodoluminescence of anodically grown SiO_2 films .... See Entry 72874

73.60K Superconducting films

Effect of argon on the superconducting transition temperature of lead-argon films .... See Entry 72534

Critical-exponent measurements of a two-dimensional superconductor .... See Entry 72548

Superconducting properties of metallic heterostructures .... See Entry 72554

Fluctuation-enhanced electrical conductivity of thin superconducting films of tin .... See Entry 72555

Pinning in NbN films .... See Entry 72562

Thermally induced resistive domains in thin superconducting indium films .... See Entry 72564

74.00 SUPERCONDUCTIVITY

74.10 OCCURRENCE, CRITICAL TEMPERATURE

72528 Influence of low temperature high pressure and high temperature high pressure treatment on structure and superconductivity of amorphous alloy $La_{80}Al_{20}$. Liu Zhi-yi, Zhao You-xiang, Liu Zhen-xing, Chen Gui-yu, Wang Chao-guo, Wang Shou-zheng (Inst. of Phys., Acad. Sinica, Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.354-9 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The rapidly quenched $La_{80}Al_{20}$ alloy is amorphous. At atmospheric pressure, its crystallisation temperature and glass temperature are ~280°C and ~242°C respectively, according to DTA measurements. The superconducting transition temperature T_c increases from 3.87 to 4.18K, in the hydrostatic pressure range of 1-4770 bars, while its residual resistance decreases significantly. After high pressure-high temperature treatment (25 kbar, ~160°C, 40 min), amorphous→crystalline transition of $La_{80}Al_{20}$ alloy occurs, as disclosed by X-ray diffraction method. The product consists of α-La phase and a new metastable phase, and its T_c increases from 3.9 to 5.7K. (27 refs.)

72529 The empirical correlations between phonon spectrum parameters λ, ⟨ω⟩, ⟨ω²⟩ and the Hall coefficients of amorphous superconductors. Cao Xiao-wen (Inst. of Plasma Phys., Acad. Sinica, Hefei, China).
Chin. Phys. (USA), vol.3, no.1, p.23-8 (Jan.-March 1983). [received: May 1983]
It is found that there is an empirical correlation between phonon spectrum parameters λ, $\langle\omega\rangle$, $\langle\omega^2\rangle$ and the Hall coefficients R_H in a variety of non-transition metals and alloys. There is a maximum of λ, $\langle\omega\rangle$ and $\langle\omega^2\rangle$ as $R_H=-3.5--4.0\times10^{-11}$ m^3/AS. There is also a similar empirical correlation between λ, $\langle\omega\rangle$, $\langle\omega^2\rangle$ and the Hall coefficients R_{HL} for the corresponding liquid metals. Finally, the question of raising T_c of amorphous superconductors is discussed. (20 refs.)

72530 Study of pressure effect on superconductivity in C-15 Laves phase alloys: (Hf, Zr, Ta)V_2 and (Hf, Zr, Nb)V_2 system. Xiong Guang-Cheng, Yin Dao-Le (Dept. of Phys., Peking Univ., Peking, China).
Chin. Phys. (USA), vol.3, no.1, p.29-35 (Jan.-March 1983). [received: May 1983]
The superconducting transition temperatures T_c and its pressure dependence $\partial T_c/\partial P$ on some C-15 Laves phase compounds, $(Zr_{0.5}Hf_{0.5-x}Ta_x)V_2$ $(x\leq0.2)$ and $(Hf_{0.5}Zr_{0.5-x}Nb_x)V_2$ $(x\leq0.2)$ system, have been studied. A description of the experimental apparatus and results is given. Unlike these cases of $(Hf_{1-x}Ta_x)V_2$ and $(Zr_{1-x}Ta_x)V_2$, introduction of Ta in $(Zr_{0.5}Hf_{0.5-x}Ta_x)V_2$ depresses T_c under normal pressure but causes a remarkably higher $\partial T_c/\partial P$. The superconducting transition temperature T_c of $(Zr_{0.5}Hf_{0.45}Ta_{0.05})V_2$ is higher than that of $(Zr_{0.5}Hf_{0.5})V_2$ at high pressure. Based on the band theory method with angular momentum representation, a new relation for the pressure dependence of electron-phonon coupling (i.e. $\partial\ln\eta/\partial\ln V$) is derived. It emphasizes the relative importance of the effect on high angular-momentum components in the conduction band electron wave function of $\partial\ln\eta/\partial\ln V$. This formation is helpful in understanding the above-mentioned experimental results and also gives a reasonable explanation of the fact that T_c of some elements, e.g. Cs, Ba, and La, is substantially enhanced by pressure. (17 refs.)

72531 First-order phase transition boundary between superconducting and SDW phases in the Bechgaard salts. K.Yamaji (Electrotech. Lab., Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1361-72 (April 1983).
Near the SDW-normal phase boundary obtained previously as a function of the transverse transfer energy t' on a quasi 1D Hubbard model, the purely superconducting state is found to extend into the SDW region, once it appears in the normal region. The titled boundary is calculated on the basis of the above-mentioned model with an anisotropic BCS-type interaction. The obtained curve well reproduces the observed *TP* phase diagram, if the author takes $t'\simeq300$ k_B and $dt'/dP\sim0.6$ k_B/kbar. A new RPA expression of the anisotropic plasma frequency for the present model provides the value of t' in remarkable agreement with the above estimate. Examination of the coupled equations for the two kinds of order parameters leads the author to conclude no microscopic coexistence of them. Quasi conductors are argued to be favourable to realise triplet superconductivity.

72532 Phase diagram and critical temperatures of nearly half-filled quasi one-dimensional conductors. Chr.Seidel, V.N.Prigodin (A.F. Ioffe Phys.-Tech. Inst., Acad. of Sci., Leningrad, USSR).
J. Phys. Lett. (France), vol.44, no.10, p.L403-9 (15 May 1983).
Considering a nearly half-filled quasi 1D conductor, variations in bandfilling and in transverse coupling are shown to have similar influence on the critical temperatures of the dielectric (CDW, AF) and superconductor (SS, TS) transitions. Provided $0<g_4<|g_3|$ a metal-to-superconductor transiton occurs at $|\delta\mu|>\delta\mu_c$ where $g_4(\delta\mu_c)=0$, or at $W_\perp>W_c$ where $W_c^2\simeq\varepsilon_F\,T_P$, respectively. Using the theoretical results the author discusses the experimental situation for the new organic conductors $(TMTSF)_2X$. (13 refs.)

72533 UBe_{13}: an unconventional actinide superconductor. H.R.Ott, H.Rudigier (Lab. fur Festkorperphys., Eidgenossische Tech. Hochschule-Honggerberg, Zurich, Switzerland), Z.Fisk, J.L.Smith.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1595-8 (16 May 1983).
Electrical-resistivity, magnetic-susceptibility, and specific-heat data reveal that UBe_{13} is superconducting below 0.85K. Highly anomalous low-temperature electronic properties in both the normal and superconducting states result in an enormous electronic specific-heat coefficient $\gamma=1.1$ J/mole K^2 and a corresponding magnetic susceptibility $\chi=1.5\times10^{-2}$ emu/mole. The superconducting state appears to be extremely stable with an initial slope of the temperature derivative of the critical field $(\partial H_{c2}/\partial T)_{Tc}=-257$ kOe/K. (18 refs.)

72534 Effect of argon on the superconducting transition temperature of lead-argon films. A.I.Eatah (Faculty of Sci., Cairo, Egypt), F.Abd El-Salam, A.Tawfik.
Phys. Status Solidi a (Germany), vol.76, no.2, p.705-8 (16 April 1983).
Lead-argon films of different composition are prepared. The superconductivity is quenched at an argon concentration of 18.5 at.%. A linear dependence of the superconducting transition temperature T_c on the reciprocal of the logarithm of the sample thickness is observed. The reduction in T_c is explained as a result of changes in the electronic band structure. (10 refs.)

72535 Superconductivity of stannous telluride at high pressure. Yu.A.Timofeev, B.V.Vinogradov, E.N.Yakovlev, E.V.Kapitanov, R.O.Kuzyan (Inst. of High-Pressure Phys., Acad. of Sci., USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1780-1 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3143-4 (Oct. 1982). [received: April 1983]
The authors report on the superconductivity of stannous telluride at high pressure. The electrical resistivity of SnTe as a function of the temperature at high pressure and low temperatures was investigated. The pressure was generated with the aid of anvils made of diamonds of the carbonado type. (8 refs.)

72536 Superconductivity at high pressures in graphite intercalation compounds. L.E.Delong, P.C.Eklund (Dept. of Phys. & Astron., Univ. of Kentucky, Lexington, KY, USA).
Synth. Met. (Switzerland), vol.5, no.3-4, p.291-300 (Feb.-April 1983).
Recent measurements of the pressure dependence of the superconducting transition temperatures of $KHgC_4$, $KHgC_8$, KC_8 and KC_{24} graphite intercalation compounds are summarized and discussed. The role of high pressure as a useful tool in exploring the phase stability, superconductivity, and other physical properties of these materials is emphasized, and possible directions for further research on these compounds are indicated. (37 refs.)

72537 Theory of superconductivity in graphite intercalation compounds. A.Shimizu, H.Kamimura (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Synth. Met. (Switzerland), vol.5, no.3-4, p.301-13 (Feb.-April 1983).
The superconducting transition temperature, T_c, of the first stage alkali-graphite intercalation compounds (GICs), particularly C_8K, has been calculated, assuming that the three-dimensional (3D) alkali-like electrons contribute to superconductivity. The authors suggest that the McMillan formula for T_c is applicable to the GIC systems, in contrast to a previous theoretical treatment by Takada (1982). Thus the mass enhancement factor of the 3D electrons due to the electron-phonon interactions is calculated from first principles. It is confirmed that the interaction with the longitudinal phonon modes in which the carbon and alkali metal atoms vibrate along the *c*-axis is very strong, while that with the phonon modes in which all the atoms vibrate along the layers is screened by the two-dimensional, graphite-like electrons. The former mechanism is characteristic of GICs and this results in superconductivity in GICs. The latter, i.e., the screening effect due to the 2D electrons, is mainly responsible for the reduction of T_c with pressure, recently observed in alkali-amalgam GICs. (12 refs.)

Superconducting and magnetic properties of ternary silicides in some rare earth-noble metal (Rh or Ir)-silicon systems ....See Entry 71942

Electronic, superconducting, and optical properties of technetium from its augmented-plane-wave band structure ....See Entry 72298

Density of states and critical resistivity of strongly disordered systems ....See Entry 72358

Specific heat anomaly of $BaPb_{1-x}Bi_xO_3$ at the superconducting transition ....See Entry 72544

Acoustic behaviour of the amorphous superconductor $Cu_{60}Zr_{40}$ at very low temperatures ....See Entry 72546

Critical-exponent measurements of a two-dimensional superconductor ....See Entry 72548

Superconducting properties of metallic heterostructures .... See Entry 72554

Fluctuation-enhanced electrical conductivity of thin superconducting films of tin ....See Entry 72555

Effect of alloying and intercalation of superconductivity of transition metal dichalcogenides ....See Entry 72558

Superconductivity of alkali metal intercalated $ZrSe_2$ ....See Entry 72559

Superconductivity of graphite intercalation compounds—stage and pressure dependence of anisotropy ....See Entry 72560

Superconducting mercury and thallium intercalation compounds ....See Entry 72561

Reductive additives in powder metallurgically prepared Cu-Nb_3Sn composite wires .... See Entry 73030

74.20 THEORY

72538 Electroweak effects in p-wave superconductors. D.Bailin (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England), A.Love.
J. Phys. A (GB), vol.16, no.8, p.L279-84 (1 June 1983).
The unification of electromagnetism and weak interactions leads to anisotropic mixing of the electroweak gauge bosons in p-wave superconductors. It also leads to parity violating components in the gap matrix. (10 refs.)

72539 On inhomogeneous patterns in non-equilibrium superconductor: μ^* model with boundary condition in one dimension. H.Konno (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.674-7 (Feb. 1983).
Inhomogeneous patterns of nonequilibrium superconductor are studied by imposing a one dimensional boundary condition upon the modified Rothwarf-Taylor equations combined with the μ^* model. The author found the bifurcation of the spatial modes and the expediency of the 'global-local' concept to understand the spatial patterns. (14 refs.)

72540 Molecular-orbital basis for superconductivity in high- and low-dimensional metals. K.H.Johnson (Dept. of Materials & Engng., MIT, Cambridge, MA, USA), R.P.Messmer.
Synth. Met. (Switzerland), vol.5, no.3-4, p.151-204 (Feb.-April 1983).
A real-space molecular-orbital description of electronic wave functions which are postulated to be the precursors of the superconducting state in high- and low-dimensional metals is presented, based on self-consistent X-alpha scattered-wave (SCF-Xα-SW) molecular-orbital calculations for clusters representing the local molecular environments in these materials. It is shown that there is a persistent correlation between the occurrence of superconductivity in a material and the existence of spatially delocalized molecular orbitals at the Fermi energy which are bonding within and antibonding between 'layers' or 'tubes' of overlapping atomic orbitals that span many atoms, forming a type of 'electron network' at the Fermi energy, as exemplified by pπ 'layered' molecular-orbital topologies in Al and $(TMTSF)_2PF_6$, and by dδ 'tubular' molecular-orbital topologies in Nb and Nb_3Sn. (115 refs.)

72541 Calculation of λ for the quasi-one-dimensional superconductor V_3Si. O.Entin-Wohlman (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel), M.Weger.
Synth. Met. (Switzerland), vol.5, no.3-4, p.217-28 (Feb.-April 1983).
The band structure and the electron-phonon coupling are calculated for a σ-band hybridized with a δ_1-band using a tight-binding parameters fit for V_3Si. The hybridization gives rise to a sharp peak in the electronic density of states near the Γ_{12} state of the δ_1-band. The variation of the parameter $N(0)I^2$ ($N(0)$—the electronic density of states at the Fermi level I^2—the electron-phonon coupling constant) is studied in the vicinity of the $\Gamma_{12}(\delta_1)$ peak. It is found that there is some compensation between $N(0)$ and I^2; the narrow δ_1-band give rise to a large value of $N(0)$, but a small value of I^2; while the σ-band gives rise to a large value of I^2, but a small value of $N(0)$. As a result, the product $N(0)I^2$ does not follow the behavior of $N(0)$ even qualitatively, and it posseses a maximum far from the peak in $N(0)$. Following this calculation, and previous calculations for the δ_2 and σ-bands, an approximate relationship is developed for the contribution λ_i to λ, coming from the various sub-bands of the 3d band, depending on the individual width of the sub-band, and its contribution to the density of states. (30 refs.)

Theory of superconductivity in graphite intercalation compounds ....See Entry 72537

74.20F BCS theory and its applications

72542 Some considerations on momentum dependence of superconductivity gap. D.Hadziahmetovic (Inst. of Phys., Univ. of Sarajevo, Sarajevo, Yugoslavia), D.Mirjanic.
Fizika (Yugoslavia), vol.15, no.1, p.37-41 (Jan.-March 1983).
It is well known that in solving of superconductivity equation it was assumed that the electron spectrum gap does not depend on momentum in actual momentum region. The authors try to solve this equation without the introduction of this simplifying assumption, and to find the momentum dependence of the superconductivity gap. The Cooper's pair radius will be also calculated. (5 refs.)

74.30 GENERAL PROPERTIES

72543 Influence of some technological factors on the energy losses in superconductors $(Nb_{1-x}Zr_x)_3Sn$ obtained by solid state diffusion. V.Kovachev.
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.63-74 (1983).
The energy losses of industrial frequencies, magnetic fields up to 1000 A/cm and temperatures 4-15K of superconducting tapes of $(Nb_{1-x}Zr_x)_3Sn (x=0$-$5\%)$ have been studied as a function of the technological parameters during their preparation. Some peculiarities in etching the bronze superconducting matrix and the effect of disrupted substrate screening on the energy losses at the higher temperatures have been considered. The optimum technological conditions for obtaining superconducting tapes of $(Nb_{1-x}Zr_x)_3Sn$ by solid state diffusion have been considered from a viewpoint of the AC properties of these superconductors. (8 refs.)

74.30C Magnetization curves, Meissner effect, penetration depth

UBe_{13}: an unconventional actinide superconductor .... See Entry 72533

Magnetic properties in the mixed state of ferromagnetic superconductors ....See Entry 72556

74.30E Thermodynamic properties; thermal conductivity

72544 Specific heat anomaly of $BaPb_{1-x}Bi_xO_3$ at the superconducting transition. M.Sato, H.Fujishita, S.Hoshino (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. C (GB), vol.16, no.13, p.L417-21 (10 May 1983).
A specific heat anomaly in $BaPb_{1-x}Bi_xO_3$ single crystals at the superconducting transition has been found by AC calorimetry, in contrast to the previous result of Methfessel et al. (1980) that no specific heat anomaly was observed. The present experimental result seems to support the idea that the superconductivity of the compounds can be described by the simple BCS theory. (18 refs.)

UBe_{13}: an unconventional actinide superconductor .... See Entry 72533

74.30G Response to electromagnetic fields, nuclear magnetic resonance, ultrasonic attenuation

72545 Amplitude dependence of ultrasonic absorption in quenched $Nb_{20}Zr_{80}$. J.L.Wang, G.Weiss, S.Hunklinger (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.533-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The ultrasonic attenuation has been measured in a quenched polycrystalline sample of $Nb_{20}Zr_{80}$ at frequencies below 100 MHz (transverse). In the superconducting state, well below the transition temperature of 8.6K, the attenuation contains an intensity dependent component. On cooling down from 1.5K this component first increases but then vanishes below 200 mK. (6 refs.)

72546 Acoustic behaviour of the amorphous superconductor $Cu_{60}Zr_{40}$ at very low temperatures. W.Arnold (Fraunhofer Inst. for Nondestructive Testing, Univ. der Saarbrucken, Saarbrucken, Germany), A.Billmann, P.Doussineau, A.Levelut.
J. Phys. Colloq. (France), vol.43, no.C-9, p.537-9 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The behaviour of acoustic waves in the amorphous superconductor $Cu_{60}Zr_{40}$ has been studied at temperatures between 70 mK and 2K. Both longitudinal and transverse waves in the 0.5-1 GHz range were used. A discontinuity in the slopes of the absorption as well as of the sound velocity at the transition temperature ($T_c=0.45K$) has been observed. These features are well explained by the tunneling model in which the acoustic behaviour is governed by the coupling of the two-level systems to the electrons in the normal state and to quasiparticles in the superconducting state. (8 refs.)

72547 Anomalous infrared absorption in granular superconductors. G.L.Carr, J.C.Garland, D.B.Tanner (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1607-10 (16 May 1983).
Granular superconductors are shown to have a far-infrared absorption that is larger when the samples are superconducting than when they are normal. By contrast, theoretical models for these materials predict that when the samples become superconducting, the absorption should decrease. (13 refs.)

74.40 FLUCTUATIONS AND CRITICAL EFFECTS

72548 Critical-exponent measurements of a two-dimensional superconductor. A.F.Hebard, A.T.Fiory (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1603-6 (16 May 1983).
Voltage-current measurements of an amorphous indium/indium-oxide thin-film composite have yielded values for the exponent $\eta(T)$ describing the power-law decay of the order-parameter correlation function appropriate to the Kosterlitz-Thouless description of phase transitions in two-dimensional systems. A pronounced crossover in the characteristics at the phase-transition temperature is obtained. Theoretical expressions both above and below T_c are verified, and a value of $\eta(T_c)=0.23$ is measured for a film with normal-state sheet resistance of 3560 Ω/□ measured at 8K. (19 refs.)

74.50 PROXIMITY EFFECTS, TUNNELLING PHENOMENA, AND JOSEPHSON EFFECT

72549 Instabilities in superconducting tunnel junctions in differential thermal environments. J.G.Adler, T.A.Will (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Appl. Phys. Lett. (USA), vol.42, no.10, p.904-5 (15 May 1983).
Instabilities in superconducting tunnel junctions have been studied in three environments: low pressure He gas, normal liquid He I, and superfluid He II. It is demonstrated that the effect arises at a bias voltage V_0 where junction dissipation is sufficient to drive a region of the electrode(s) normal. The transition is accompanied by a small excess current, which is due to the appearance of electrode resistance and junction heating. For Pb electrode junctions immersed in liquid He the critical junction dissipation marks the outset of film boiling, which shows up as excessive noise in the tunneling curves. This critical heat flux, $\simeq 1$ W/cm² at 4.2K, limits the useful energy range for tunneling spectroscopy and leads to catastrophic burnout of high density Josephson arrays. (16 refs.)

72550 Imaging of spatial structures in superconducting tunnel junctions by electron-beam scanning. H.Seifert, R.P.Huebener (Phys. Inst. II, Univ. Tubingen, Tubingen, Germany), P.W.Epperlein.
Phys. Lett. A (Netherlands), vol.95A, no.6, p.326-30 (9 May 1983).
The voltage change caused in a current-biased superconducting tunnel junction by scanning the junction surface with an electron beam can serve to generate a two-dimensional image of spatial structures within the specimen. Depending upon the bias point during the scanning process, an image of local variations in the tunneling current density due to variations of the tunnel barrier resistance or in the energy gaps of the electrodes is obtained. PbAuIn/PbBi cross-line and SiO-window junctions have been used to demonstrate this imaging technique. (6 refs.)

72551 On the microscopic theory of the proximity effect in normal metal-superconductor sandwiches. A.D.Zaikin, G.F.Zharkov (Dept. of Theoretical Phys., Lebedev Inst., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.331-4 (9 May 1983).
A theory of the proximity effect in clean normal metal-superconductor sandwiches at low temperatures $T \ll T_c$ is developed. It is shown that the value of the superconducting order parameter near the NS-interface is equal to nearly half of its value Δ_0 far from the NS-interface. The distance at which $\Delta(x)$ changes to Δ_0 is of the order of ξ_0. (9 refs.)

72552 Transient response of superconducting indium microbridges to supercritical current pulses. D.J.Frank, M.Tinkham (Phys. Dept., Harvard Univ., Cambridge, MA, USA), A.Davidson, S.M.Faris.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1611-14 (16 May 1983).
Superconducting sampling circuits have been used to investigate the transient response of long indium microbridges to current pulses in excess of their critical currents. For the first time, the rising-edge kinetic inductance spike and the nonzero minimum voltage have been observed, as well as the delay time until the normal state appears. These results are in reasonable agreement with a detailed theoretical model of the experiment and yield an estimate of 140 ps for τ_E, the inelastic scattering time, in indium. (18 refs.)

72553 Flux quantization in a superconducting closed loop with more than two Josephson junctions. W.Richter, F.Dettmann (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K95-8 (1 April 1983).
The critical current versus magnetic flux characteristic of a DC SQUID with two Josephson junctions is periodic in the magnetic flux with a periodicity of one flux quantum Φ_0. The authors have investigated theoretically the flux quantization of a superconducting closed loop composed of 2n series Josephson junctions and an inductance. (3 refs.)

72554 Superconducting properties of metallic heterostructures. I.K.Schuller (Argonne Nat. Lab., Argonne, IL, USA), C.M.Falco.
Synth. Met. (Switzerland), vol.5, no.3-4, p.205-16 (Feb.-April 1983).
Reviews recent results on the superconducting properties of artificially prepared metallic heterostructures. The sputtering system used to prepare these materials is described in detail along with a calculation of the thermalization of sputtered atoms. The structure of Nb/Cu and Nb/Ti heterostructures is discussed, as are T_c, energy gap, and phonon frequency measurements. (29 refs.)

74.55 TYPE-I SUPERCONDUCTIVITY

72555 Fluctuation-enhanced electrical conductivity of thin superconducting films of tin. S.B.Kalra, P.N.Dheer (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India).
Indian J. Cryog., vol.7, no.4, p.177-83 (1982).
Measurements of the excess electrical conductivity of thin superconducting films of tin (thickness much less than the temperature dependent coherence length) due to thermodynamic fluctuations of the order parameter above the transition temperature, T_c have been carried out on films deposited on (a) glass substrates held at ~300K, (b) glass substrates held at ~77K and (c) glass substrates precoted with a layer of LiF and held at ~300K. The study has been carried out at low as well as moderately high electric fields. (28 refs.)

74.60 TYPE-II SUPERCONDUCTIVITY

74.60E Mixed state, H_{c2}, surface sheath

72556 Magnetic properties in the mixed state of ferromagnetic superconductors. O.Sakai (Dept. of Phys., Tohoku Univ., Sendai, Japan), M.Suzuki, S.Maekawa, M.Tachiki, G.W.Crabtree, F.Behroozi.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1341-51 (April 1983).
The lower and the upper critical fields H_{c1} and H_{c2}, and the slope of magnetisation at H_{c2}, $(\partial M/\partial H)_{c2}$, are calculated in ferromagnetic superconductors. The theory takes account of the electromagnetic and the s-f exchange interactions between conduction electrons and localised f-electrons. When temperature decreases, $(\partial M/\partial H)_{c2}$ in the mixed state increases and diverges at a certain temperature. This indicates that below this temperature, the transition at H_{c2} is of a first order. Near the spin ordering temperature, H_{c2} decreases more rapidly than H_{c1} with decreasing temperature. The theoretical results are compared with experimental results in single crystals $ErRh_4B_4$ in detail. (40 refs.)

72557 Upper critical field in two-dimensional superconductors. S.Maekawa (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1352-60 (April 1983).
The upper critical field in two-dimensional superconductors is calculated by taking into account quantum corrections due to the Anderson localisation to the theory of dirty superconductors in the order of $(\epsilon_F\tau_0)^{-1}$ where ϵ_F and τ_0 are the Fermi energy and the relaxation time of an electron, respectively. The upper critical field is enhanced at low temperatures. This is because the diffusion constant of electrons is depressed and the Coulomb repulsive interaction modified by the localisation becomes small in the magnetic field. Discussion is given on the upward curvature of upper critical field of layered superconductors in the field perpendicular to the layers.

72558 Effect of alloying and intercalation of superconductivity of transition metal dichalcogenides. M.Ikebe, Y.Muto (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Synth. Met. (Switzerland), vol.5, no.3-4, p.229-44 (Feb.-April 1983).
The superconducting transition temperature T_c and the anisotropy ratio of the upper critical field parallel and perpendicular to the layer plane have been measured on 2H- and 4Ha-$Nb_{1-x}Ta_xSe_2$ mixed crystals and on 2H-$Ta_{1-x}Nb_xS_2$ with and without pyridine intercalation. 4Hb-$Ta_{0.95}Nb_{0.05}S_2$ and 4Hb-$Ta_{0.95}Nb_{0.05}S_2(Py)_{1/2}$ which have a mixed coordination structure have also been studied. The results have been analyzed on the basis of the KLB theory of quasi-two-dimensional superconductivity. The analyses show that the mixed crystal system remains in strongly anisotropic three-dimensional superconductivity. On the other hand, the anomalously large anisotropy of the H_{c2} of intercalation compounds can only be explained by the use of the KLB theory, indicating attainment of quasi-two-dimensional superconductivity. In the 4Hb crystal, the layers are more strongly decoupled, and the existence of semimetallic octahedral layers has been found to be important in determining the interlayer superconductive coupling. (23 refs.)

72559 Superconductivity of alkali metal intercalated $ZrSe_2$. Y.Onuki (Saitama Inst. of Technol., Saitama-ken, Japan), S.Yamanaka, R.Inada, M.Kido, S.Tanuma.
Synth. Met. (Switzerland), vol.5, no.3-4, p.245-55 (Feb.-April 1983).
Alkali metal intercalated $ZrSe_2(A_xZrSe_2)$ has been synthesized by the reaction of $ZrSe_2$ single crystals with n-butylithium in hexane solution, or alkali metals (Na, K, Rb, Cs) in hexamethylphosphoric triamide solution. Semiconducting $ZrSe_2$ has been converted into a metallic substance by the alkali metal intercalation. Superconductivity has been found for Li_x-, Na_x-, K_x-, Rb_x- and Cs_xZrSe_2 $(0<x\leq 1)$ below 1.7, 2.0, 2.1, 1.7, and 1.4, respectively. The angular dependence of the upper critical fields H_{c2} for A_xZrSe_2 is interpreted by the effective mass model. The Ginzburg-Landau coherence lengths perpendicular to the layer planes of the crystals at zero temperature are ten to twenty times larger than the layer repeat distances, showing a three-dimensional character. Anisotropic superconductivity is discussed on the basis of the Fermi surface of A_xZrSe_2 whose electron number is determined by the charge transfer from alkali metal atoms to $ZrSe_2$. (16 refs.)

72560 Superconductivity of graphite intercalation compounds—stage and pressure dependence of anisotropy. Y.Iye, S.Tanuma (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Synth. Met. (Switzerland), vol.5, no.3-4, p.257-76 (Feb.-April 1983).
Superconductivity of graphite intercalation compounds with KHg, RbHg and $KTl_{1.5}$ was studied with a particular emphasis on the two-dimensional anisotropy. The stage and pressure dependence of the critical field clearly manifests the way to two-dimensionality is controlled by changing the layer separations. It is argued that the major part in the superconductivity of this class of materials is played by electrons in the intercalant band rather than those in the graphitic band. (10 refs.)

72561 Superconducting mercury and thallium intercalation compounds. L.A.Pendrys, R.A.Wachnik, F.L.Vogel (Lab. for Res. On The Structure of Matter, Univ. of Pennsylvania, Philadelphia, PA, USA), P.Lagrange.
Synth. Met. (Switzerland), vol.5, no.3-4, p.277-90 (Feb.-April 1983).
Superconducting properties of the graphite intercalation compounds, $KHgC_8$, $RbHgC_8$, $KTl_{1.5}C_4$ and $KTl_{1.5}C_8$, having T_c values of 1.9, 1.44, 2.7 and 2.45K, respectively, have been studied using an AC magnetic susceptibility technique. The second critical field, H_{c2}, of $KTl_{1.5}C_4$ was extrapolated from measurements to ≈20 kOe at zero temperature for the DC magnetic field applied perpendicular to the $\vec{c}$-axis. A nearly temperature independent anisotropy of ≈5 was observed. The compound $KHgC_8$ has an extrapolated anisotropy in H_{c2} of ≈25 at T_c which appears to increase strongly at reduced temperatures. However, the extrapolated value at $T=0$ is ≈3 kOe for the magnetic field perpendicular to the $\vec{c}$-axis. The values at T_c and H_{c2} determined for $KTl_{1.5}C_4$ are the highest observed to date in a graphite intercalation compound. In spite of large values of H_{c2} and of anisotropy in H_{c2}, no clear evidence of quasi 2D behavior is evident at any temperature and anisotropic 3D models should describe superconducting behavior in these compounds. (30 refs.)

UBe_{13}: an unconventional actinide superconductor .... See Entry 72533

74.60G Flux pinning; fluxon-defect interactions

72562 Pinning in NbN films. Ding Shiying (Dept. of Phys., Nanjing Univ., Nanjing, China).
Chin. Phys. (USA), vol.3, no.1, p.169-72 (Jan.-March 1983). [received: May 1983]
An analysis is made of experimental data of NbN thin films prepared by reactive sputtering. Results show that the magnetic field variation of the pinning force density F_p could be fitted to the Kramer relation,

$F_p \sim b^{1/2}(1-b)^2$, where b is the normalized induction. A study has been made of the flux pinning mechanisms in films. The authors have also compared the $J_c(H)$ of NbN with those of other high field superconductors, foreseeing the possibility of technical applications of B1 compounds. (5 refs.)

72563 Computer simulation of flux pinning in type-II superconductors. E.H.Brandt (Inst. fur Phys., Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Phys. Rev. Lett. (USA), vol.50, no.20, p.1599-602 (16 May 1983).
Random point pinning of ideal or defective flux-line lattices is simulated on a computer. For weak pins, Larkin and Ovchinnkov's (1979) two-dimensional collective pinning is confirmed: $j_c = \text{const} \times n_p \langle f_p^2 \rangle / R_p c_{66}$ (j_c is the critical current; n_p, f_p, and R_p are the density, force, and range of pins; and c_{66} is the shear modulus). The constant is determined. Defective lattices are pinned more strongly by factors 1.3 to 3, explaining the observed history effect. A pronounced jump in the curves $j_c(f_p)$ indicates the onset of plastic deformation. (17 refs.)

72564 Thermally induced resistive domains in thin superconducting indium films. Yu.M.Ivanchenko, P.N.Mikheenko (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.380-8 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.684-98 (Aug. 1982). [received: May 1983]
A phenomenological theory describing localized resistive regions in superconducting thin films is used to introduce the concept of elementary resistive domains which are analogs of phase slip centers characteristic of superconducting thin channels and microbridges. The main feature of elementary resistive domains is the same as that of phase slip centers: energy dissipation in the domains occurs in a region of width $2l_E$, where l_E is the depth of penetration of a longtitudinal electric field into the superconductor. It is shown that the number of jumps in the current-voltage characteristic of a film with a domain, recorded under constant-current conditions, is a function of the parameters of the film and is independent of the thermostat temperature. An estimate of l_E is obtained using the experimental current-voltage characteristics of elementary domains and allowing for the inhomogeneous distribution of the current across the film width. Experiments are reported in which resistive domains (including elementary ones) are induced by heaters in the form of evaporated copper films. Characteristic features of domains formed in the presence of a heater include a wide range of currents in which such domains exist, and their disappearance on switching off the heater if the value of the transport current does not exceed a certain critical value, the threshold nature of the excitation at low rates of heat flow, etc. The mechanism of formation of these superdomains is explained schematically and experiments are considered for the separate determination of the currents responsible for the appearance of domains. (17 refs.)

74.60J Critical currents

72565 Influence of a current and of a magnetic field on the properties of magnetic superconductors of the HoMo$_6$S$_8$ type. A.I.Buzdin, L.N.Bulaevskii, S.V.Panyukov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.430-40 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.768-86 (Aug. 1982). [received: May 1983]
The authors investigate the properties of the inhomogeneous domain-type magnetic structure (DS phase) produced in magnetic superconductors such as $HoMo_6S_8$ in the region where superconductivity and magnetism coexist. They show that the superconducting critical current in the *DS* phase decreases to zero when the temperature is lowered to $T_{c2}^{(c)}$ (the supercooling temperature of the *DS* phase). The wave vector of the magnetic structure decreases at the same time with increasing current flowing through the sample. They investigate the behavior of the *DS* in a magnetic field, obtain the phase diagram in the (H,T) plane. In the region where the field penetrates, the *DS* phase is substantially altered: new peaks $2nQ$ (n is an integer) appear in the neutron scattering, and the wave vector Q decreases with increasing field. (12 refs.)

Pinning in NbN films .... See Entry 72562

Computer simulation of flux pinning in type-II superconductors .... See Entry 72563

Reductive additives in powder metallurgically prepared Cu-Nb$_3$Sn composite wires .... See Entry 73030

74.70 SUPERCONDUCTING MATERIALS

74.70G Type-I superconductors (non transition metals)

Density of states and critical resistivity of strongly disordered systems .... See Entry 72358

The empirical correlations between phonon spectrum parameters λ, $\langle\omega\rangle$, $\langle\omega^2\rangle$ and the Hall coefficients of amorphous superconductors .... See Entry 72529

Effect of argon on the superconducting transition temperature of lead-argon films .... See Entry 72534

Anomalous infrared absorption in granular superconductors .... See Entry 72547

Fluctuation-enhanced electrical conductivity of thin superconducting films of tin .... See Entry 72555

74.70L Type-II superconductors (transition metals, alloys and compounds)

Superconducting and magnetic properties of ternary silicides in some rare earth-noble metal (Rh or Ir)-silicon systems .... See Entry 71942

Electronic, superconducting, and optical properties of technetium from its augmented-plane-wave band structure .... See Entry 72298

Influence of low temperature high pressure and high temperature high pressure treatment on structure and superconductivity of amorphous alloy La$_{80}$Al$_{20}$ .... See Entry 72528

Study of pressure effect on superconductivity in C-15 Laves phase alloys: (Hf, Zr, Ta)V$_2$ and (Hf, Zr, Nb)V$_2$ system .... See Entry 72530

First-order phase transition boundary between superconducting and SDW phases in the Bechgaard salts .... See Entry 72531

UBe$_{13}$: an unconventional actinide superconductor .... See Entry 72533

Superconductivity of stannous telluride at high pressure .... See Entry 72535

Superconductivity at high pressures in graphite intercalation compounds .... See Entry 72536

Theory of superconductivity in graphite intercalation compounds .... See Entry 72537

Calculation of λ for the quasi-one-dimensional superconductor V$_3$Si .... See Entry 72541

Specific heat anomaly of BaPb$_{1-x}$Bi$_x$O$_3$ at the superconducting transition .... See Entry 72544

Amplitude dependence of ultrasonic absorption in quenched Nb$_{20}$Zr$_{80}$ .... See Entry 72545

Acoustic behaviour of the amorphous superconductor Cu$_{60}$Zr$_{40}$ at very low temperatures .... See Entry 72546

Magnetic properties in the mixed state of ferromagnetic superconductors .... See Entry 72556

Effect of alloying and intercalation of superconductivity of transition metal dichalcogenides .... See Entry 72558

Superconductivity of alkali metal intercalated ZrSe$_2$ .... See Entry 72559

Superconductivity of graphite intercalation compounds—stage and pressure dependence of anisotropy .... See Entry 72560

Superconducting mercury and thallium intercalation compounds .... See Entry 72561

Pinning in NbN films .... See Entry 72562

Influence of a current and of a magnetic field on the properties of magnetic superconductors of the HoMo$_6$S$_8$ type .... See Entry 72565

Large anisotropic vibrational correlations in *A*15 Nb$_3$Ge .... See Entry 72885

Reductive additives in powder metallurgically prepared Cu-Nb$_3$Sn composite wires .... See Entry 73030

74.70N Dirty superconductors

Upper critical field in two-dimensional superconductors .... See Entry 72557

Effect of alloying and intercalation of superconductivity of transition metal dichalcogenides .... See Entry 72558

74.70P Materials for high-field applications

Influence of some technological factors on the energy losses in superconductors (Nb$_{1-x}$Zr$_x$)$_3$Sn obtained by solid state diffusion .... See Entry 72543

74.90 OTHER TOPICS IN SUPERCONDUCTIVITY

72566 High magnetoresistivity of a system of weakly coupled superconducting chains. K.B.Efetov (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France).
J. Phys. Lett. (France), vol.44, no.10, p.L369-74 (15 May 1983).
The resistivity of a system of weakly coupled superconducting chains with breaks is calculated. It is shown that an external magnetic field can influence considerably this resistivity. (7 refs.)

72567 Remarks on the experiment of winding number dependence of the Aharonov-Bohm effect. A.Inomata (Dept. of Phys., State Univ. of New York, Albany, NY, USA).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.176-8 (25 April 1983).
A theoretical basis is provided for the recent experimental demonstration of the winding number dependence of the Aharonov-Bohm effect by Deaver and Donaldson (see ibid., vol.89, p.178, 1982). An N-turn superconducting ring around flux is shown to have quantized flux states with $\Delta\Phi = \Phi_0/N = hc/(2Ne)$. (9 refs.)

75.00 MAGNETIC PROPERTIES AND MATERIALS

(see also 81.40R Magnetic properties related to materials treatment; for galvanomagnetic effects, see 72.15G and 72.20M; for magneto-optical effects, see 78.20L)

75.10 GENERAL THEORY AND MODELS OF MAGNETIC ORDERING

(see also 05.50 Ising problems, 71.25 Nonlocalized single-particle electronic states, 71.70 Level splitting and interactions)

72568 Ground-state entropy of the *q*-state Potts antiferromagnet in a magnetic field. D.S.Hajdukovic, S.Milosevic (Dept. of Phys. & Meteorology, Faculty of Natural & Math. Sci., Belgrade, Yugoslavia).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.249-51 (2 May 1983).
Presents a simple method to obtain reliable ground-state entropies of the q-state Potts antiferromagnet in an external magnetic field. As an example, the ground-state entropy for the triangular lattice is established for all q. In the particular case $q=2$, the authors method gives results which coincide with the first-order approximation obtained by the corner transfer matrix method. (6 refs.)

75.10H Ising and other classical spin models

72569 Time-dependent correlation functions of the transverse Ising chain at the critical magnetic field. B.M.McCoy, J.H.H.Perk, R.E.Shrock (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.35-47 (16 May 1983).
The authors study the correlation function $\langle\sigma_0^x(t)\sigma_n^x(0)\rangle$ of the transverse Ising model in a critical field whose Hamiltonian is ${}^1/_2\Sigma_l\{\sigma_l^x\sigma_{l+1}^x - \sigma_l^z\}$. At an arbitrary temperature T they relate the autocorrelation to a Fredholm determinant. Moreover at $T=0$ the correlations are given by a Painleve V function for all n. The long-time asymptotic behavior of this function is found and the connection problem is studied. This result contains oscillatory terms which are related to the density of states at the Brillouin zone boundary. (14 refs.)

72570 Critical amplitudes for the random Ising system. S.A.Newlove (Phys. Dept., Univ. of Edinburgh, Edinburgh, Scotland).
J. Phys. C (GB), vol.16, no.13, p.L423-6 (10 May 1983).
The critical amplitude ratios C_+/C_-, A_+/A_- and f_+/f_- are calculated to one loop and compared with their experimental values. (8 refs.)

72571 The antiferromagnetic phase of the Ising model with first- and second-neighbour interactions. J.Doczi-Reger, P.C.Hemmer (Inst. of Theoretical Phys., Univ. of Trondheim, Trondheim, Norway).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K67-71 (1 April 1983).
Two-dimensional Ising systems with nearest-neighbour (nn) and next-nearest-neighbour (nnn) interactions can model interesting physical systems as adsorbed atoms on crystal surfaces, or layered crystals. The authors obtain analytic results for the phase boundary for the antiferromagnetic phase. They use the interface method to determine this second-order transition line. Although the interface method is approximate it has in several instances been shown that it yields qualitatively correct and even qualitatively good results. (7 refs.)

Exact models with a complete Devil's staircase ....See Entry 70013

Description of the phase with broken symmetry in the Ising model by the method of quasi-averages ....See Entry 70018

Boost operator and its application to quantum Gelfand-Levitan equation for Heisenberg-Ising chain with spin one-half ....See Entry 72574

On the magnetic structure of a hexagonal Ising antiferromagnetic ....See Entry 72583

Antiferromagnetic triangular Ising model: an exact calculation of $P(h)$ ....See Entry 72618

Frustrated Ising chains. IV ....See Entry 72619

One-dimensional Ising model in a random field ....See Entry 72623

Critical behaviour of the correlation function of the Ising model with impurity bonds ....See Entry 72626

75.10J Heisenberg and other quantized localized spin models

72572 Analysis of the Bethe ansatz equations of the XXZ model. O.Babelon, H.J.de Vega, C.M.Viallet (Lab. de Phys. Theorique et Hautes Energies, Paris, France).
Nucl. Phys. B, Field Theory & Stat. Syst. (Netherlands), vol.B220 (FS8), no.1, p.13-34 (16 May 1983).
The authors analyse the Bethe ansatz equations of the *XXZ* model in the antiferromagnetic region, without assuming a priori the existence of strings. Excited states are described by a finite number of parameters. These parameters satisfy a closed system of equations, which they obtain by eliminating the parameters of the vacuum from the original Bethe ansatz equations. Strings are only particular solutions of these equations. (9 refs.)

72573 On the gauge equivalence of the Landau-Lifshitz and the nonlinear Schrodinger equations on symmetric spaces. V.G.Makhankov, O.K.Pashaev (Joint Inst. for Nuclear Res., Dubna, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.95-100 (18 April 1983).
The gauge equivalence between a generalized Heisenberg spin chain (G/H) in the classical and continuum limit and the nonlinear Schrodinger equation (NLSE), with special attention to noncompact groups, is established. It has been demonstrated that noncompact groups allow a richer spectrum of possible reductions of the Heisenberg system to the NLSE. Some specialities of the model with nontrivial boundary conditions are discussed. The gauge equivalence between single-axis anisotropic Landau-Lifshitz equations (LLE) and isotropic LLE is briefly discussed. (13 refs.)

72574 Boost operator and its application to quantum Gelfand-Levitan equation for Heisenberg-Ising chain with spin one-half. K.Sogo, M.Wadati (Inst. of Phys., Univ. of Tokyo, Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.431-50 (Feb. 1983).
The quantum inverse scattering problem for the Ising-like *XXZ* model is studied. It is found that the boost operator plays an essential role in the analysis. In terms of the boost operator, the bound state operators are defined and the quantum Gelfand-Levitan equation is derived in a natural way. The quantum inverse scattering problem for the *XY*-like *XXZ* model is also discussed. In addition, the boost operators for Calogero (1975) systems and Toda lattice are explicitly given. (24 refs.)

Critical dynamics at the percolation threshold by fractal and scaling approaches ....See Entry 72628

75.20 DIAMAGNETISM AND PARAMAGNETISM

Dynamic polarization and NMR of nuclei in the immediate vicinity of paramagnetic impurity centers ....See Entry 72712

75.20C Nonmetals

72575 Magnetic susceptibility of neutron and electron irradiated quartz versus the 'glassy' thermal conductivity. C.Laermans (Phys. Dept., Katholieke Univ., Leuven, Leuven, Belgium), A.Van den Bosch, J.Cornelis, J.Vansummeren.
J. Phys. Colloq. (France), vol.43, no.C-9, p.513-16 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Static magnetic susceptibility measurements have been carried out on crystalline quartz samples after fast neutron irradiation and high energy electron irradiation, both for two doses. The samples were these used for former thermal conductivity measurements or had been joined, during irradiation, to the samples in which dynamic experiments have been done before so that their 'glassy' behavior is known. While the thermal conductivity shows a comparable decrease for the two kinds of irradiation at temperatures below 1K, the behavior of the static paramagnetic susceptibility is different for both kinds of irradiation. Consequently, the tunneling states and the paramagnetic centers are not directly related. (13 refs.)

72576 On the magnetic behaviour of some hydrogen bonded molecules in crystals. M.M.Abdel-Kader (Phys. Dept., Univ. of Cairo, Giza, Egypt).
Mol. Phys. (GB), vol.48, no.6, p.1145-54 (20 April 1983).
The effect of the hydrogen bonding on the magnetic anisotropy of *o*-halogenobenzoic acids and some derivatives of phenol, namely 2-aminophenol, 2,3-dimethylphenol and 2-methyl-3-bromophenol, is studied. These molecules are of known crystal structures. The crystal susceptibilities (χ_1, χ_2 and χ_3) of each compound were measured. From these measurements and the molecular orientation, the principal molecular susceptibilities (K_1, K_2 and K_3) have been calculated. The observed magnetic data are interpreted in the light of the structures of these molecules and their hydrogen bonding systems. (42 refs.)

72577 Magnetic interactions in solid oxygen. R.J.Meier (Natuurkundig Lab., Univ. van Amsterdam, Amsterdam, Netherlands).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.115-17 (18 April 1983).
A semi-empirical model is applied to describe the magnetic properties of solid oxygen. The behaviour of the susceptibility is explained and a magnetic three-sublattice structure for β-oxygen is found to be favoured over a two-sublattice structure. (7 refs.)

Structural and magnetic data on $EuSi_2$ ....See Entry 71940

Superconducting and magnetic properties of ternary silicides in some rare earth-noble metal (Rh or Ir)-silicon systems ....See Entry 71942

Spin polarization and relaxation in magnetically doped semiconductors ....See Entry 72579

Magnetic properties of the compound $HfFe_2Si_2$ ....See Entry 72633

Magnetic properties of $REFe_2Si_2$ compounds ....See Entry 72636

Optical polarization of nuclear angular momenta in amorphous Si-Dy ....See Entry 72700

Giant spin splitting of exciton states and optically detected magnetic resonance in A^2B^6 crystals containing magnetic impurities ....See Entry 72715

Studies of EPR, spin, and phonon kinetics in parametic ionic crystals using Mandel'shtam-Brillouin and Raman scattering of light ....See Entry 72817

75.20E Metals and alloys

72578 The magnetic properties of 3*d* impurities: Fe and Mn in Nb_3Ga A15 type matrix. J.Sosnowski (Electrotech. Inst., Warsaw, Poland), T.Mydlarz.
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.455-60 (April 1983).
The results of the investigations of magnetic properties of Fe and Mn impurities in Nb_3Ga A15 type matrix are presented. The values of the Curie-Weiss parameters for arc-melted $Nb_{78}Ga_{22-x}Fe_x$, $Nb_{80}Ga_{20-x}Mn_x$ and annealed $Mb_{78}Ga_{22-x}Mn_x$ samples are given. Observed dependences are interpreted according to the model of the influence of nearest environment of given impurity atom on its magnetic properties. On the basis of this suggestion other magnetic parameters of impurities such as: number of magnetic atoms, mean exchange field, pair breaking have been estimated. (11 refs.)

UBe_{13}: an unconventional actinide superconductor ....See Entry 72533

Experimental curves of entropy and susceptibility versus temperature for copper nuclear spins down to the ordered state ....See Entry 72605

The Invar effect and spin fluctuations in disordered Fe_3Pt ....See Entry 72610

75.20H Local moment in dilute alloys; Kondo effect

(see also 72.15Q Electronic conduction)

72579 Spin polarization and relaxation in magnetically doped semiconductors. Yu.G.Semenov (Inst. of Electrical Semiconductors, Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.31-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.449-51 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
A description is given of exchange scattering of photocarriers by localized magnetic moment in which the effective exchange field produced by the latter, which leads to giant spin splitting of energy bands in magnetically doped semiconductors, is taken into account. An expression is given for the corresponding probability of relaxation spin transitions. (4 refs.)

72580 Special solution of the mode-coupling equations for a two-component magnetic system. W.Schattke (Inst. fur Theoretische Phys., Univ. Kiel, Kiel, Germany).
J. Stat. Phys. (USA), vol.30, no.3, p.607-15 (March 1983).
The validity of the vertex approximation for the nonlinear Langevin equations has been investigated in the special case of a two-component magnetic system without spatial correlation. The exact solution of the equation resulting from the vertex approximation is compared with that of the original equation. Agreement is found in the regime of small nonlinearity. In the opposite regime, especially near a critical slowing down, both solutions differ significantly. (6 refs.)

The magnetic properties of 3*d* impurities: Fe and Mn in Nb_3Ga A15 type matrix ....See Entry 72578

Optical polarization of nuclear angular momenta in amorphous Si-Dy ....See Entry 72700

Giant spin splitting of exciton states and optically detected magnetic resonance in A^2B^6 crystals containing magnetic impurities ....See Entry 72715

75.25 SPIN ARRANGEMENTS IN MAGNETICALLY ORDERED MATERIALS (NEUTRON STUDIES, ETC)

72581 A possibility of triple-Q incommensurate magnetic structure in $RbFeCl_3$-type triangular antiferromagnets. H.Shiba (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan), N.Suzuki.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1382-6 (April 1983).
A theoretical examination is made on whether the triple-Q incommensurate magnetic structure can be realised in $RbFeCl_3$-type magnets. A comparison of free energies among the single-Q, double-Q and triple-Q states shows that there is a good chance to have the triple-Q phase in this system. An argument based on the ϵ expansion is also presented in this connection.

72582 Magnetic properties of $Cr_{1/3}NbS_2$. T.Miyadai, K.Kikuchi (Dept. of Phys., Hokkaido Univ., Sapporo, Japan), H.Kondo, S.Sakka, M.Arai, Y.Ishikawa.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1394-401 (April 1983).
An intercalated 2H-type layer compound, $Cr_{1/3}NbS_2$, was investigated by magnetic and neutron diffraction measurements. It was found that this compound is a helimagnet with a very long period along the *c*-axis and with the spins in the *c*-plane. The magnetic behaviour is similar to that of an easy-plane type ferromagnet except for the magnetisation curve in the *c*-plane. The Curie temperature is 127K. The saturation magnetisation corresponds to 2.9 μ_B/Cr. The uniaxial anisotropy constant, K_1, is -1.46×10^6 ergs/cc at 4.2K. The magnetisation curve in the *c*-plane shows a metamagnetic behaviour, the critical field of which is as low as 1.5 kOe except near T_c. Small angle scattering measurements showed a helical structure with $Q=0.013$ Å^{-1} (480

Å period). The helical spin structure and the metamagnetism is explained as due to the antisymmetric exchange interaction. (12 refs.)

72583 On the magnetic structure of a hexagonal Ising antiferromagnetic. F.Matsubara (Dept. of Engng. Sci., Tohoku Univ., Sendai, Japan).
Solid State Commun. (USA), vol.46, no.4, p.329-32 (April 1983).
Domain wall free energies are calculated in a hexagonal Ising antiferromagnet and shown to be very small compared with those in an ordinary two-sublattice antiferromagnet. It is suggested that the magnetic structure of its higher temperature ordered phase is one in which many domains are tangled with each other. Some comments are given on experimental results in $CsCoCl_3$ and $CsCoBr_3$. (10 refs.)

72584 Surface magnetic structure analysis of Ni(001) by polarized electron diffraction. R.Feder (Theoretische Festkorperphys., Univ. Duisburg, Duisburg, Germany), S.F.Alvarado, E.Tamura, E.Kisker.
Surf. Sci. (Netherlands), vol.127, no.1, p.83-107 (April 1983).
For spin-polarized low-energy electrons diffracted from ferromagnetic Ni(001), the exchange- and the spin-orbit-induced scattering asymmetries A_{ex} and A_{so} of two diffracted beams have been simultaneously measured at $T=300K$ and at $T=520K$ for several constant energies as functions of the polar angle of incidence. Corresponding 'rocking curves' calculated by dynamical theory are in generally good agreement with the data. Analysis of A_{so} shows firstly that an energy-dependent exchange approximation is adequate, secondly that the topmost interlayer spacing is essentially bulk-like with a possible slight outward relaxation (1%), and thirdly that 3p→3d excitation is significant. From A_{ex} the following magnetic information is obtained: The surface magnetization for $T=300K$ and 520K is such as to imply, via extrapolation by mean field theory, a $T=0$ value slightly enhanced (by $+5\%\pm5\%$) with respect to the bulk magnetization. The spin asymmetries of localized and uniform inelastic processes are very small, leading, for incident electron energy 69 and 89 eV, to a combined inverse mean free path asymmetry of less than 0.3%. (47 refs.)

Crystal structure and magnetic state of pseudobinary intermetallic compounds $Ho(Co_{1-x}Ni_x)_5$ .... See Entry 71929

Influence of a current and of a magnetic field on the properties of magnetic superconductors of the $HoMo_6S_8$ type .... See Entry 72565

Neutron scattering in insulating semi-spin glass .... See Entry 72609

Evolution from ferromagnetism to spin-glass behavior .... See Entry 72616

75.30 MAGNETICALLY ORDERED MATERIALS, OTHER INTRINSIC PROPERTIES

(for critical point effects, see 75.40)

75.30C Saturation moments and magnetic susceptibility

72585 Magnetic history of hexanediammonium tetrachloroferrate(II). M.A.Semary, M.M.Abdel-Kader, M.F.Mostafa (Phys. Dept., Faculty of Sci., Univ. of Cairo, Giza, Egypt).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.641-4 (29 April 1983).
The magnetic susceptibility of the two-dimensional antiferromagnet $(CH_2)_6(NH_3)_2\ FeCl_4$ is reported. The compound has unusual dependence on its magnetic history below its Neel temperature T_N. Though the magnetic ordering is associated with a structural distortion, this distortion does not seem to explain the magnetic behaviour of the compound. The results have been interpreted in terms of mixed magnetic phases which are likely to exist when the sample is cooled in a magnetic field. (11 refs.)

72586 Magnetic properties of bulk amorphous alloy Dy_4Co_3. A.Apostolov (Faculty of Phys., Sofia Univ., Sofia, Bulgaria), H.Hristov, T.Midlag, M.Mikhov, V.Skumriev.
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.159-64 (April 1983).
The magnetic susceptibility was investigated by the transition balance method in the 77-400K temperature range, and the magnetization was studied in the temperature range 4.2-300K using a vibrating sample magnetometer in magnetic fields up to 60 kOe, and by a ballistic magnetometer in magnetic fields up to 140 kOe. The temperature dependence of saturation magnetization (σ_s), remanent magnetization (σ_r), coercivity (H_c) and anisotropy (W) were obtained from the hysteresis loops and the initial magnetization curves. The temperature changes of σ_s and σ_r were qualitatively similar, showing well defined maxima at 40K and minima at 20K. The transition temperature from the paramagnetic to magnetic ordered state—$T_c=(69.5\pm0.5)K$—was determined from the magnetization curves by the Belov-Goryaga thermodynamic method. (10 refs.)

72587 Magnetic ordering of the intermetallic compound Gd_2Au. H.Gamari-Seale, V.Bredimas (Nuclear Res. Centre, Demokritos, Attikis, Greece).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.131-5 (April 1983).
Magnetization measurements on polycrystalline Gd_2Au indicate that the magnetic ordering of the compound is extremely sensitive to the sample preparation, thus explaining the contradictory results reported in the literature. (6 refs.)

72588 Magnetic properties of the R_5Sb_3 compounds (R=La, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm and Y). J.K.Yakinthos, I.P.Semitelou (School of Engng., Democritos Univ. of Thrace, Xanthi, Greece).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.136-40 (April 1983).
Susceptibility measurements were performed on the rare earth antimonides with the composition R_5Sb_3 in the temperature range 4.2 to 300K under a constant magnetic field of 1 kOe. All the compounds, except La_5Sb_3 and Y_5Sb_3, show an antiferromagnetic behaviour with Neel temperatures between 12 K(Tm) and 109 K(Gd). La_5Sb_3 and Y_5Sb_3 show a temperature independent susceptibility. (6 refs.)

Crystal structure and magnetic state of pseudobinary intermetallic compounds $Ho(Co_{1-x}Ni_x)_5$ .... See Entry 71929

Formation process in MnBi thin films by Williams' method .... See Entry 72270

Magnetic interactions in solid oxygen .... See Entry 72577

Experimental curves of entropy and susceptibility versus temperature for copper nuclear spins down to the ordered state .... See Entry 72605

Phase transitions in random anisotropy magnets .... See Entry 72607

The Invar effect and spin fluctuations in disordered Fe_3Pt .... See Entry 72610

Observation of quantum fluctuations in FeSi .... See Entry 72611

Spin glass behavior of some rapidly quenched iron (2+) aluminosilicates .... See Entry 72612

Magnetic properties of the compound $HfFe_2Si_2$ .... See Entry 72633

The saturation magnetization of some substituted Fe-Si-B metallic glasses. II .... See Entry 72635

75.30D Spin waves

(see also 76.50 Spin wave resonance)

72589 Surface magnetostatic waves at an interface between two magnetic materials. I.A.Gilinskii (Inst. of Semiconductor Phys., Siberian Branch, Acad. of Sci., Novosibirsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.455-8 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A theoretical study is used to show that the low-frequency branch of such waves represents true surface oscillations, i.e. it does not dissociate as a result of emission of bulk magnons into the interiors of the two crystals. (11 refs.) *A.T.*

72590 Spectrum and damping of spin waves in size-quantized ferromagnetic semiconductor films. M.Sh.Erukhimov (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1751-4 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3096-101 (Oct. 1982). [received: April 1983]
A study is made of the spin wave spectrum in size-quantized ferromagnetic films with an *s-d* exchange interaction. The regions of collisionless Landau damping are determined. The behavior of the dispersion laws of the lower and upper spin wave branches at the boundaries of such regions is investigated. New quantum spin waves are obtained in triangular transparency windows. It is shown that the damping of the lower and upper spin wave branches exhibits strong oscillations when the magnon wave vector and the thickness of the film are varied. The oscillation period and the temperature dependence of the oscillation amplitude are determined. (11 refs.)

72591 Boundaries of the long-wavelength part of the spin wave spectrum. A.V.Lavrinenko, G.A.Melkov, N.A.Davidenko (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1776-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3136-7 (Oct. 1982). [received: April 1983]
The upper and lower boundaries of spin wave spectra in yttrium iron garnet (YIG) single crystals were detected experimentally at room temperatures for wave vectors k→0. The experiments were carried out on spherical samples of diameter 1.5-3 mm magnetized in the direction of the [111] easy axis with FMR line widths of 0.3-0.5 Oe. The position of the upper boundary of the spin wave spectrum was determined from the minimum of the threshold of the longitudinal spin wave pumping. The frequency corresponding to the lower boundary of the spectrum was determined by exciting dynamic instability in ferrites, which gave rise to spin waves at the bottom of the spectrum. The frequency of such waves can be determined from their electromagnetic radiation. (6 refs.)

72592 Relaxation in ferromagnetic metals. S.O.Gladkov (INst. of Chem. Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.452-5 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.806-12 (Aug. 1982). [received: May 1983]
The interaction between nuclear spin waves and conduction electrons is considered. It is shown that these processes are very important at infralow temperatures. They lead to large scattering probabilities and determine the establishment of the thermodynamic equilibrium in the subsystems. A theory of relaxation in ferromagnetic metals at intraflow temperatures is developed. (11 refs.)

72593 Kinetic theory of parametric excitation of spin waves in the case of parallel pumping. V.P.Seminozhenko, V.L.Sobolev, A.A.Yatsenko (Donets Physicotech. Inst., Acad. of Sci., Ukrainian SSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.907-13 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.443-52 (Sept. 1982). [received: May 1983]
Kinetic equations are constructed for normal and anomalous mean values of the type $f_p=\langle a_p{}^+ a_p\rangle$, $\sigma_p=\langle a_p a_{-p}\rangle$ ($a_p{}^+$, a_p are magnon operators) for ferromagnets under conditions of parallel pumping. Expressions are obtained for the generalized collision integrals in the equations for the functions f_p and σ_p. Methods of obtaining solutions of the kinetic equations in a steady regime are discussed. An equation is formulated that describes the nonequilibrium states of the magnons in a region of the spectrum far from resonance. (14 refs.)

72594 Excitation and propagation of dimensionless magnetostatic types of waves and oscillations in rectangular yttrium-iron-garnet rods. B.E.Zhurilenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.585-91 (April 1983). In Russian.
The spectrum of magnetostatic body waves (MSBW) and volume oscillations (MSVO) has been investigated in a rectangular yttrium-iron-garnet rod under excitation by different antenna systems. It is shown theoretically and experimentally that, besides modes with the wave number depending on sample dimensions, it is possible to excite MSBW and MSVO modes differing only in the wave field structure. For these 'dimensionless' modes dispersion dependences and expressions are obtained which describe the wave field structure both inside and outside the sample. (9 refs.)

Magnetic transition state approach to ferromagnetism of metals:Ni .... See Entry 72603

Evolution from ferromagnetism to spin-glass behavior .... See Entry 72616

Stoner excitations in the strong itinerant amorphous ferromagnets $Fe_xNi_{80-x}BI_{18}Si_2$ and $Fe_{80}B_{20}$ .... See Entry 72637

Spin wave resonance in ferromagnets with dislocations forming a periodic layered structure .... See Entry 72678

75.30E Exchange and superexchange interactions

(see also 71.70 Level splitting and interactions)

72595 Widths of magnetic exciton lines exhibited by cubic Laves phases $PrAl_2$ and $PrNi_2$. V.L.Aksenov, E.A.Goremychkin, T.Frauenheim (Joint Inst. for Nuclear Res., Dubna, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.496-502 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Experimental data on the inelastic scattering of neutrons were used to consider the temperature dependence of the line width of localized magnetic excitations in rare-earth intermetallics $PrAl_2$ and $PrNi_2$ on the basis of the s-f exchange model. (12 refs.) *A.T.*

72596 Exchange interaction in oxygen-bridged dimers of copper (II) with aromatic *N*-oxides. I. Method of calculation and application to di-μ-(pyridine *N*-oxide)-bis [dichlorocopper(II)]. S.F.A.Kettle, G.R.Tsaparlis (School of Chem. Sci., Univ. of East Anglia, Norwich, England).
J. Chem. Phys. (USA), vol.78, no.8, p.5004-12 (15 April 1983).
A method, based on the Dirac-Van Vleck-Serber permutation degeneracy model, for the estimation of the exchange integral J in oxygen-bridged dimers of copper (II) with aromatic *N*-oxides is demonstrated for the case of the dimer di-μ-(pyridine *n*-oxide)-bis (dichlorocopper II), $[(C_6H_5NO)CuCl_2]_2$. The calculations are limited to the planar three-center, four-electron system Cu(↑)-O(↑↓)-Cu(↑), with due account of the second bridging oxygen and all omitted atoms or electrons. The computational details and approximations are discussed. It is found that J is sensitive to the structural data, the atomic orbitals and functions used, the ionic state of copper, and configuration interaction (inclusion of excited, charge-transfer configurations). The exchange interaction is mediated by a σ superexchange pathway, all π pathways being excluded. Finally, both the oxygen 2*s* and 2*p* orbitals contribute to J. (56 refs.)

Random fields in disordered magnetics with Jahn-Teller ions ..See Entry 72361

Structure and magnetism in a hydroxy bridged binuclear copper(II) system with a 'tunable' binuclear centre ....See Entry 72364

Correlation of electrical resistivity and heat capacity of silicides of rare-earth metals with the composition R_5Si_4 ....See Entry 72402

Spin polarization of electron-hole plasma in Mn-doped ZnTe . See Entry 72430

Spin polarization and relaxation in magnetically doped semiconductors ....See Entry 72579

Magnetic properties of $Cr_{1/3}NbS_2$ ....See Entry 72582

Surface magnetic structure analysis of Ni(001) by polarized electron diffraction ....See Entry 72584

Effect of pressure on the Curie temperature of $CuCr_2Se_{4-x}Br_x$ ....See Entry 72601

Magnetic properties of $Pr_xY_{1-x}Co_5$ and $Pr_xSm_{1-x}Co_5$ crystals ....See Entry 72634

Exchange interactions in bis(diethyldithiocarbamato)copper (II), Cu(detc)$_2$ ....See Entry 72663

Approximate theory of FMR and AR in weakly conducting ferromagnetic bulk metals ....See Entry 72679

Giant spin splitting of exciton states and optically detected magnetic resonance in A^2B^6 crystals containing magnetic impurities ....See Entry 72715

75.30G Anisotropy

72597 Magnetic anisotropy in $(Fe,Co)_{75}Si_{15}B_{10}$ and $(Fe_{0.11}Co_{0.89})_{72}Mo_3Si_{15}B_{10}$ metallic glass ribbons, induced by constant stress and constant strain annealing. O.V.Nielson, L.K.Hansen (Dept. of Electrophys., Tech. Univ. of Denmark, Lyngby, Denmark), A.Hernando, V.Madurga.
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.73-80 (April 1983).
The magnetic anisotropy induced by constant tensile stess and constant torsional strain annealing has been studied for liquid quenched alloys of the compositions $(Fe_xCo_{1-x})_{75}Si_{15}B_{10}$ (x=0.1-1.0) and $(Fe_{0.11}Co_{0.89})_{72}Mo_3Si_{15}B_{10}$. Within a certain annealing temperature range (depending on composition, pre-annealing time, applied stress and stress-annealing duration) the induced easy axis is perpendicular to the ribbon axis. After subsequent stress relief the easy axis turns parallel to the ribbon axis. The easy ribbon axis anisotropy produced in this way reveals a similar composition dependence as the anisotropy obtained by magnetic field annealing but the anisotropy constant may be up to one order of magnitude larger, depending on the stress annealing conditions. In contrast to the field anneal induced anisotropy, the stress anneal induced anisotropy can be made permanent in the sense that it still remains after subsequent stress relief. It is furthermore shown that constant strain annealing induced anisotropy can be deduced from the properties observed after constant stress annealing, and a method for selecting proper stress relaxation conditions, with the purpose of obtaining maximum magnetic softness (isotropy) is proposed. (15 refs.)

72598 Separation into two contributions of stress anneal induced magnetic anisotropy in metallic glass ribbons. O.V.Nielsen (Dept. of Electrophys., Tech. Univ. of Denmark, Lyngby, Denmark).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.81-5 (April 1983).
Stress annealing experiments followed by stress relief experiments on metallic glass ribbons have made it possible quantitatively to separate the stress anneal induced magnetic anisotropy K_u into the terms of opposite sign, K_{an} and K_{pl}. These terms, labelled anelastic and plastic, respectively, show very different dependences on the annealing conditions. The measurements of K_u of either sign were made possible by use of the small signal inverse Wiedemann effect in twisted ribbons as recently described. (20 refs.)

Random fields in disordered magnetics with Jahn-Teller ions ..See Entry 72361

Dependence of the magnetoresistance on dispersion properties of Permalloy films with allowance for the angular spatial dispersion of the anisotropy ....See Entry 72518

Magnetic properties of $Cr_{1/3}NbS_2$ ....See Entry 72582

Magnetic properties of bulk amorphous alloy Dy_4Co_3 ....See Entry 72586

Impurity atom with an easy-plane anisotropy in a ferromagnet with an easy-axis anisotropy and ferromagnetic resonance ....See Entry 72599

Phase transitions in random anisotropy magnets ....See Entry 72607

Magnetic properties of $Pr_xY_{1-x}Co_5$ and $Pr_xSm_{1-x}Co_5$ crystals ....See Entry 72634

75.30H Magnetic impurity interactions

72599 Impurity atom with an easy-plane anisotropy in a ferromagnet with an easy-axis anisotropy and ferromagnetic resonance. A.I.Lukanin, M.V.Medvedev (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.441-9 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An analysis is made of a Heisenberg ferromagnet with a single-ion anisotropy of the easy-axis type containing magnetic impurity ions with a single-anisotropy of the easy-plane type. It is shown that a certain number of spin deviations from the state of an ideal parallel alignment of the impurity and matrix spins may occur in the ground state. Moreover, impurity spins with the easy-plane anisotropy can give rise to discrete energy levels in the gap of the spin-wave spectrum. These levels correspond to spin excitations of two types; one which reduces the spontaneous magnetization of a crystal, whereas the other increases such magnetization. A study is made on how ferromagnetic resonance can be used to distinguish these types of spin excitation. (9 refs.) *A.T.*

Critical behaviour of the correlation function of the Ising model with impurity bonds ....See Entry 72626

75.30K Magnetic phase boundaries

(inc. magnetic transitions, metamagnetism, etc)

72600 Model of magnetic phase transition in a monolayer of molecules that are chemosorbed on the surface of a nonmagnetic metal. V.D.Borman, L.A.Maksimov, A.P.Popov, V.I.Troyan (Moscow Engng. Phys. Inst., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.49-53 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1269-74 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors consider the magnetic phase transition in a molecular monolayer on the surface of a nonmagnetic metal. To describe the experimental findings, the authors modify Kittel's model, taking account of the temperature dependence of the magnetic moments of the sublattices and the case of different filling numbers for the sublattices. To correctly allow for these relationships, they employ the Hamiltonian in Kittel form and they obtain a model expression for the free energy within the framework of molecular field theory. (9 refs.)

72601 Effect of pressure on the Curie temperature of $CuCr_2Se_{4-x}Br_x$. T.Kanomata (Dept. of Appl. Phys., Tohoku Gakuin Univ., Miyagi, Japan), K.Shirakawa, T.Kaneko.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1387-93 (April 1983).
The pressure derivative of the Curie temperature $\partial T_c/\partial p$ of $CuCr_2Se_{4-x}Br_x$ ($0.0 \leq x \leq 1.0$) have been obtained from the results of measurement of temperature dependence of initial permeability (μ) at various pressures. The Curie temperature decreases linearly with pressure for all of as-prepared samples. The magnitude of the negative value of $\partial T_c/\partial p$ for $CuCr_2Se_{4-x}Br_x$ decreases with increasing Br content from -1.67K/kbar at x=0.0 to -0.35K/kbar at x=0.8. The pressure effect on the magnetisation of $CuCr_2Se_{4-x}Br_x$ has also been studied by the forced magnetostriction. On the basis of these results, the composition dependences of the Curie temperature, the magnetisation and the exchange interaction are determined. Moreover, the strain dependence of the exchange interaction is also obtained. The exchange striction is also studied for $CuCr_2Se_{3.5}Br_{0.5}$. (18 refs.)

72602 Magnetic relaxation measurements in FeCr alloys. A.C.Palumbo (Dept. of Phys., Univ. of Rochester, Rochester, NY, USA), R.D.Parks, Y.Yeshurun.
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.66-72 (April 1983).
Detailed magnetic measurements are presented for Fe_xCr_{1-x}, $0.12 \leq x \leq 0.24$. The authors focus on irreversible phenomena and present magnetic viscosity measurements for external magnetic fields 100 Oe$\leq H \leq$3 kOe, in the temperature range 1.5K$\leq T \leq$7.5K. They find the border lines of the spin-glass phase via the disappearance of irreversible relaxation and construct a magnetic phase diagram for FeCr in the *H-T-x* space. (20 refs.)

72603 Magnetic transition state approach to ferromagnetism of metals:Ni. A.I.Liechtenstein, V.A.Gubanov (Inst. for Chem., Sverdlovsk, USSR), M.I.Katsnelson, V.I.Anisimov.
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.125-30 (April 1983).
The generalization of Slater's magnetic transition state approach of the case of continuous energy distribution of d-states in metals is suggested. The method developed allows the first-principle calculations of local spin excitation energies. The connection of these magnetic excitations to the spin-wave spectrum and Curie temperature T_c for an arbitrary type of magnetic interaction is established. Using the X_α-SW cluster method with k-dependent boundary conditions the numerical calculations of magnetic excitation energies and T_c for Ni have been carried out in very reasonable agreement with experimental values available. (22 refs.)

72604 A Mossbauer study of the variation in Neel temperature in iron-rare earth layer compounds. J.A.Birch, M.F.Thomas (Oliver Lodge Lab., Univ. of Liverpool, Liverpool, England).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.141-50 (April 1983).
A Mossbauer study of the layer compounds $Sr_{1/2}La_{3/2}Li_{1/2}Fe_{1/2}O_4$, $Sr_{1/2}Pr_{3/2}Li_{1/2}Fe_{1/2}O_4$, $Sr_{1/2}Nd_{3/2}Li_{1/2}F_{1/2}O_4$ which contain iron in a tetravalent state, measured their Neel temperatures as (29.2±1)K, (29.2±1)K and (35.2±1)K, respectively. These values of Neel temperature are discussed in terms of interlayer separation and the magnetic nature of the interlayer rare earth ions. (4 refs.)

72605 Experimental curves of entropy and susceptibility versus temperature for copper nuclear spins down to the ordered state. M.T.Huiku, T.A.Jyrkkio, M.T.Loponen (Low Temperature Lab., Helsinki Univ. of Technol., Espoo, Finland).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1516-19 (9 May 1983).
The entropy and susceptibility of copper nuclear spins below 1 μK have been measured as a function of temperature both in the paramagnetic and in the antiferromagnetic states. The critical temperature is 63±10 nK, about 30% of the mean-field estimate. The results are in agreement with calculations based on the spin-wave spectrum of the dipolar and the Ruderman-Kittel interactions in the FCC lattice of copper. (15 refs.)

72606 High-pressure and extended X-ray-absorption fine-structure study of Cr-rich Cr-Ge alloys. R.Munch, H.D.Hochheimer, A.Werner (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), G.Materlik, A.Jayaraman, K.V.Rao.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1619-22 (16 May 1983).
From the pressure dependence of the Neel temperature (T_N) in Cr-Ge alloys, the antiferromagnetic transition is found to be the commensurate state, when Ge is greater than 0.6 at.%. The present extended X-ray absorption fine-structure study on Cr-Ge shows clearly that Ge goes substitutionally into the Cr lattice. On the basis of the rigid-band model this can be understood only if Ge acts as an electron donor to the d band of Cr. These findings raise the interesting question as to how Si and Ge additions stabilise the commensurate phase, despite their smaller e/a ratio. (16 refs.)

72607 Phase transitions in random anisotropy magnets. M.J.O'Shea, S.G.Cornelison, Z.D.Chen, D.J.Sellmyer (Behlen Lab. of Phys., Univ. of Nebraska Lincoln, NE, USA).
Solid State Commun. (USA), vol.46, no.4, p.313-16 (April 1983).
The authors report a study of magnetic properties and phase transitions in random anisotropy glasses rich in the rare-earth elements Gd, Tb and Nd. For the Gd glass, which has a small magnetic anisotropy, they find an extremely large, possibly infinite, susceptibility below 120K and no intrinsic spontaneous magnetization. Below 55k an hysteretic state develops. The Tb and Nd glasses, both of which have large anisotropy, exhibit transitions to a speromagnetic state and they do not show an infinite susceptibility phase. The results are discussed in terms of recent theoretical predictions concerning phase transitions in the presence of random magnetic anisotropy. (13 refs.)

Crystal structure and magnetic state of pseudobinary intermetallic compounds Ho(Co$_{1-x}$Ni$_x$)$_5$ .... See Entry 71929

Superconducting and magnetic properties of ternary silicides in some rare earth-noble metal (Rh or Ir)-silicon systems .... See Entry 71942

Acoustic properties of a gadolinium single crystal in the region of magnetic phase transitions .... See Entry 72051

Resistance of the amorphous magnetic alloy Fe$_{29}$Ni$_{49}$P$_{14}$B$_6$Si$_2$ as a function of temperature and stress .... See Entry 72372

Influence of a current and of a magnetic field on the properties of magnetic superconductors of the HoMo$_6$S$_8$ type .... See Entry 72565

Magnetic properties of Cr$_{1/3}$NbS$_2$ .... See Entry 72582

Magnetic history of hexanediammonium tetrachloroferrate(II) .... See Entry 72585

Magnetic properties of bulk amorphous alloy Dy$_4$Co$_3$ .... See Entry 72586

Magnetic properties of the R$_5$Sb$_3$ compounds (R=La, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm and Y) .... See Entry 72588

The Invar effect and spin fluctuations in disordered Fe$_3$Pt .... See Entry 72610

Competing ferromagnetic and spin-glass order in a *Au*Fe alloy .... See Entry 72615

Heat capacity of alloys with interacting magnetic-order parameters .... See Entry 72617

Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy .... See Entry 72638

Magnetic evidence for the existence of RCo$_z$ with $z \approx 7$ (R=La, Ce, Pr and Nd) .... See Entry 72641

Spectrum of magnetization oscillations in a uniaxial ferromagnetic plate .... See Entry 72647

Magnetic interaction in plastically deformed FePt$_3$ alloy .... See Entry 72651

75.30S Magnetocaloric effect

Optical cooling of the nuclear spin system of a semiconductor in conjunction with adiabatic demagnetization .... See Entry 72706

75.40 CRITICAL-POINT EFFECTS, SPECIFIC HEATS, SHORT-RANGE ORDER

(inc. spin glasses)

72608 Spin-glass with short-range interaction induced by an electromagnetic field in semiconductors. I. Low temperatures domain. M.Crisan, Z.Gulacsi, M.Gulacsi (Dept. of Phys., Cluj Univ., Cluj, Rumania).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.47-55 (April 1983).
The spin-glass state which occurs due to the spin-spin interaction induced by an electromagnetic field in semiconductors is analyzed on the base of the Abrikosov-Moukhin model. The specific heat and the magnetic susceptibility are calculated at low temperatures on the two domains. The matching between these domains has been explained and the matching temperature has been calculated. The domain near the critical temperature has been treated using the percolation model. (4 refs.)

72609 Neutron scattering in insulating semi-spin glass. G.Gavoille (Lab. d'Electrite et d'Automatique, Faculte de Sci., Nancy, France), J.Hubsch.
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.89-94 (April 1983).
A semi-spin glass which consists of a *Z* ferro, antiferro or ferrimagnetic spin component and of *X-Y* spin glass component, exhibits a very specific neutron diffraction pattern looking like very broad Bragg reflections. Experimental data are compared to theoretical estimations. (6 refs.)

72610 The Invar effect and spin fluctuations in disordered Fe$_3$Pt. K.R.A.Ziebeck (Inst. Laue Langevin, Grenoble, France), P.J.Webster, P.J.Brown, H.Capellmann.
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.151-9 (April 1983).
Below 297K chemically disordered Fe$_3$Pt orders ferromagnetically with a moment per formula unit of 8.6 μ_B at 4.2K. Above the Curie temperature the inverse static susceptibility varies linearly with temperature. These observations are at variance with recent models of the Invar effect which assume an instability of the iron moment in the FCC lattice. Paramagnetic scattering experiments, using polarised neutrons and polarisation analysis in the paramagnetic phase of Fe$_3$Pt reveal significant magnetic scattering which is peaked in the forward direction. The spatial correlations which give rise to the forward scattering are of a predominantly ferromagnetic nature extending over approximately 12-16 Å and persist above 2.65 T_C. Integration of the paramagnetic response over an inverse atomic volume yields a moment per iron atom of 2.18 μ_B at 1.33 T_C which reduces to 1.73 μ_B at 2.65 T_C. The spatial correlations are of paramount importance in characterizing the paramagnetic properties of Fe$_3$Pt and must therefore be considered in any discussion of the static susceptibility and Invar properties. (21 refs.)

72611 Observation of quantum fluctuations in FeSi. K.R.A.Ziebeck, H.Capellmann, P.J.Brown, P.J.Webster (Inst. Laue Langevin, Grenoble, France).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.160-4 (April 1983).
Polarised neutrons and polarisation analysis have been used to determine the diffuse magnetic scattering from FeSi as a function of temperature. The variation of the scattering as a function of *Q* is indicative of spatial correlations of magnetic moment extending over several interatomic distances. At 100K the correlations are predominantly antiferromagnetic in character, but become increasingly ferromagnetic with increasing temperature. It is the thermal variation of these correlations which gives the unusual temperature dependence of the static susceptibility. The amplitude of the moment, estimated by integrating of observed response over an inverse atomic volume, was found not to vary significantly with temperature. A quantitative interpretation of these results is given in terms of a model in which FeSi shows properties of a heavy Fermi liquid. (14 refs.)

72612 Spin glass behavior of some rapidly quenched iron (2+) aluminosilicates. A.Schnell, J.C.Bernier (Dept. Sci. des Materiaux, ENSCS, Strasbourg, France), J.P.Sanchez.
Mater. Res. Bull. (USA), vol.18, no.3, p.251-5 (March 1983).
Reports on the magnetic and structural properties of ferrous iron aluminosilicate glasses investigated by DC susceptibility, magnetization and ^{57}Fe Mossbauer measurements. (8 refs.)

72613 An order parameter theory on the frequency-dependent susceptibility of spin glasses. K.Honda (Dept. of Appl. Phys., Nagoya Univ., Nagoya, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.179-82 (25 April 1983).
By making use of the free energy given in a previous paper, conventional kinetic equations for order parameters and for what was named an internal field parameter are investigated to calculate the dynamical susceptibility. The significant features observed in recent experiments are described successfully. (11 refs.)

72614 Speckle picture of spin-glasses and inhomogeneous mean field theory. J.R.Provost, G.Vallee (Phys. Theorique, IMSP Univ. de Nice, Nice, France).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.183-5 (25 April 1983).
The authors show that the mean field $H(r)$ is an order parameter for spin-glasses. It has a 'speckle' type spatial dependence. The difference between the critical temperatures for the specific heat and the magnetic susceptibility is explained in terms of inhomogeneous solutions of the equation for H in a speckle. (7 refs.)

72615 Competing ferromagnetic and spin-glass order in a *Au*Fe alloy. I.A.Campbell, S.Senoussi (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), F.Varret, J.Teillet, A.Hamzic.
Phys. Rev. Lett. (USA), vol.50, no.20, p.1615-18 (16 May 1983).
Magnetic and Mossbauer measurements on a *Au*-19-at.%-Fe alloy are reported. After ferromagnetic ordering at $T_c \simeq 170$K, spin-glass-like transverse ordering sets in below $T \simeq 15$K. This behaviour is consistent with the predictions of a Heisenberg mean-field model, in which the transverse ordering transition is distinct from a crossover to strong irreversibility. (23 refs.)

72616 Evolution from ferromagnetism to spin-glass behavior. J.W.Lynn, R.W.Erwin (Dept. of Phys., Univ. of Maryland, College Park, MD, USA), H.S.Chen, J.J.Rhyne.
Solid State Commun. (USA), vol.46, no.4, p.317-20 (April 1983).
The magnetic properties of amorphous (Fe$_x$Ni$_{100-x}$)$_{75}$p$_{16}$B$_6$Al$_3$ have been investigated in the critical concentration region ($x_c = 17$) via neutron scattering. For $x > x_c$ a transition to ferromagnetism is first observed followed at lower temperatures by an evolution to spin-glass behavior. Associated with this low temperature state are two distinct time scales corresponding to a resolution-limited elastic peak and to excitations. The temperature dependence of the elastic component is directly related to the spin-glass order parameter and indicates that there is a region of temperature where ferromagnetism and spin-glass order coexist. (19 refs.)

72617 Heat capacity of alloys with interacting magnetic-order parameters. N.I.Kourov, Yu.N.Tsiovkin, S.M.Podgornykh, N.V.Volkenshtein (Inst. of Metal Phys., Acad. of Sci., USR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.367-70 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.662-7 (Aug. 1982). [received: May 1983]
The heat capacity C_p of (Pd$_x$Pt$_{1-x}$)$_3$Fe alloys ordered in an FCC lattice is investigated in the temperature interval 20-300K at a concentration phase transition from the ferromagnetic (F) state at $x=1$ into the antiferromagnetic (AF) at $x=0$. The concentration and temperature dependences of C_p are discussed with account taken of the experimentally reconstructed magnetic-state diagram of these alloys. It is shown that the observed singularities of $C_p(T,x)$ are due mainly to the change of the magnetic state of the alloy. The possible type of polycritical points that appear on the phase transition line with respect to the antiferromagnetic order parameter is analyzed. (19 refs.)

Correlation of electrical resistivity and heat capacity of silicides of rare-earth metals with the composition R$_5$Si$_4$ .... See Entry 72402

Widths of magnetic exciton lines exhibited by cubic Laves phases PrAl$_2$ and PrNi$_2$ .... See Entry 72595

Magnetic relaxation measurements in FeCr alloys .... See Entry 72602

Magnetic transition state approach to ferromagnetism of metals:Ni .... See Entry 72603

Experimental curves of entropy and susceptibility versus temperature for copper nuclear spins down to the ordered state .... See Entry 72605

Phase transitions in random anisotropy magnets .... See Entry 72607

The magnetic contribution to specific heat in thin ferromagnetic films .... See Entry 72643

ESR in the two phases of the magnetic semiconductor GaCr$_4$S$_8$ .... See Entry 72658

75.40D Ising and other classical spin models

72618 Antiferromagnetic triangular Ising model: an exact calculation of *P*(*h*). T.C.Choy, D.Sherrington (Phys. Dept., Imperial Coll., London, England).
J. Phys. A (GB), vol.16, no.8, p.L265-8 (1 June 1983).
Using exact results for the nearest-neighbour two, four and six spin correlations, the authors have evaluated the local field probability distribution function $P(h)$ for the (fully frustrated) triangular antiferromagnetic Ising lattice in its ground state. (20 refs.)

72619 Frustrated Ising chains. IV. B.G.S.Doman, M.A.Z.Habeeb (Dept. of Appl. Math. & Theoretical Phys., Univ. of Liverpool, Liverpool, England).
J. Phys. C (GB), vol.16, no.13, p.2591-601 (10 May 1983).
The methods of Williams (1981) and Doman and Williams (1982) are used in investigating the ground-state and low-temperature properties of an Ising chain with bonds which are successively ferromagnetic or antiferromagnetic at random. If the ferromagnetic bonds are stronger than the antiferromagnetic ones, the properties are essentially the same as when they have the same strength. If the ferromagnetic bonds are weaker, there is a step in the magnetisation when the magnetic field is equal to the difference in the strengths of the ferro- and antiferromagnetic bonds. For smaller magnetic fields all the frustrated bonds are ferromagnetic. Further steps in thermodynamic properties occur for values of magnetic field B=the ferromagnetic bond strength ×2/integer. (6 refs.)

72620 Spin glasses with RKKY-type interactions; numerical studies on small samples. C.Bergonzoni (Istituto di Fisica, Univ. di Modena, Modena, Italy), G.Lo Vecchio, G.Morandi.
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.2, p.71-6 (14 May 1983).
The authors perform a systematic numerical study of spatially-disordered models of spin-glasses with interactions of the RKKY type. A finite model is used, in which $S=9$ Ising spins are randomly distributed on a $9\times9\times9$ simple cubic lattice. Results for the order parameter on a finite sample and in mean-field theory are presented. (10 refs.)

72621 First-order phase transitions in Potts and Ising systems. J.Bricmont (Inst. de Phys. Theorique, Univ. de Louvain, Louvain-la-Neuve, Belgium), J.L.Lebowitz, A.Messager.
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.169-72 (25 April 1983).
The authors use an equivalence between the q-state Potts model on a d-dimensional lattice for $q=2^n$, $n=1, 2, \ldots$ and a spin 1/2 Ising model on n copies of the lattice with 2 n-spin ferromagnetic interactions to obtain some exact new results for both systems. In particular they prove the existence of first-order phase transitions for a class of ferromagnetic Ising systems obtained as perturbations of the large q Potts-Ising system and the non-vanishing of the surface tension for the Potts model (with $q=2^n$) at all temperatures below their transition temperature. (13 refs.)

72622 Analyticity of the free energy of the two-dimensional random Ising model. H.Nishimori (Serin Phys. Lab., Rutgers Univ., Piscataway, NJ, USA).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.303-4 (9 May 1983).
It is shown that the systematic-expansion method of the free energy of the two-dimensional random Ising model, by Hoever and Zittartz (1982), does not lead to evidence for the absence of a spin glass transition as they claimed. (4 refs.)

72623 One-dimensional Ising model in a random field. R.Bruinsma (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), G.Aeppli.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1494-7 (9 May 1983).
The one-dimensional Ising model in a random field is studied with use of a functional recursion relation. For temperatures exceeding a given value, the fixed function of the relation is found and shown to be a devil's staircase. From this result it is possible to evaluate the free energy to arbitrary precision. In the field-strength-temperature plane, a crossover line corresponding to the onset of frustration is found. (10 refs.)

72624 Static and dynamic critical magnetic fields in Ising spin-glasses. W.Kinzel, K.Binder (Inst. fur Festkorperforschung, Kernforschungsanlage Julich, Julich, Germany).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1509-11 (9 May 1983).
By Monte Carlo simulations it is shown that the magnetization $M(t,H)$ of the two-dimensional nearest-neighbor Edwards-Anderson model is proportional to H^{1-x}, essentially independent of temperature T, for fields $H<H_c^{eq}(T)$, with $H_c^{eq}(T)\propto T^{1/x}$, the exponent being $x\approx0.28\pm0.06$. Irreversible behavior on a time scale t sets in for a field $H_c(t)$ where $H_c(t)/T_f(t)$ nearly follows the De Almeida-Thouless line, although no static nonzero freezing temperature T_f exists. Consequences for the interpretation of related experimental work are discussed. (23 refs.)

72625 Dynamics of the infinite-range Ising spin glass. K.H.Fischer (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Solid State Commun. (USA), vol.46, no.4, p.309-11 (April 1983).
The Glauber dynamics of an Ising spin glass with infinite-range interactions and additional static field, h, is investigated near the freezing temperature, T_f. The author obtains critical slowing down at and below the de Almeida-Thouless instability line (1978), $h_c(T)$, to order $(1-T/T_f)^3$ with algebraic decay of the spin correlations $\sim t^{-\nu}$, where $\nu=1/2$ at T_f and $\nu\leq1/2$ for $T<T_f$. (25 refs.)

72626 Critical behaviour of the correlation function of the Ising model with impurity bonds. V.S.Dotsenko, V.S.Dotsenko (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.406-14 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.727-42 (Aug. 1982). [received: May 1983]
The authors consider a two-dimensional Ising model with a small impurity bond concentration. At the phase transition point they evaluate exactly the correlation function $\Gamma(R)\equiv\langle\sigma(0)\sigma(R)\rangle$. In contrast to the pure Ising model, where $\Gamma(R)\propto R^{-\zeta}$, $\zeta={}^1/_4$, the exponent ζ of the correlator turns out to be equal to zero when there are impurity bonds present. At distances $R\gg r_i\propto e^{1/\nu}$, where $\nu\ll1$ is the impurity bond concentration, $\Gamma(R)$ is a function which varies much more weakly than a powerlaw function. (12 refs.)

Non-universal corrections to scaling for a lattice model ....See Entry 70010

The antiferromagnetic phase of the Ising model with first- and second-neighbour interactions ....See Entry 72571

75.40F Heisenberg and other quantized spin models

72627 On the zero-temperature critical behaviour of the quantum *X-Y* model in a transverse magnetic field. T.K.Kopec, G.Kozlowski (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.104-6 (18 April 1983).
It is shown that the zero-temperature critical behaviour of the quantum-mechanical *X-Y* spin model in a transverse magnetic field is characterized by pure gaussian critical exponents. Remarks on the universality of the quantum critical behaviour are also made. (14 refs.)

72628 Critical dynamics at the percolation threshold by fractal and scaling approaches. C.K.Harris, R.E.Stinchcombe (Dept. of Theoretical Phys., Oxford Univ., Oxford, England).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1399-402 (2 May 1983).
The critical dynamics of Heisenberg spin systems at the percolation threshold is obtained from the transformation of the equations of motion under a length scaling achieved by elimination of sites. The method is applied exactly to d-dimensional nonrandom fractals representing the infinite-cluster backbone and approximately to a truly random two-dimensional system to yield dynamic scaling forms for response function and characteristic frequency, and associated static and dynamic critical exponents. (18 refs.)

72629 Topological phase transition in the *XY* model of a spin glass. I.E.Dzyaloshinskii, S.P.Obukhov (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.456-66 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.813-32 (Aug. 1982). [received: May 1983]
The Villain variant of the XY model of a spin glass is considered in the three-dimensional case. It is shown that there occurs in the system of topological phase transition connected with the appearance of frustration lines of infinite length. In the phase thus produced, the correlation distance at zero temperature is infinite. At any finite temperature, however, the correlation has a finite range. The possibility of generalization to the Heisenberg model of spin glasses is discussed. (21 refs.)

One-dimensional quantum-spin-phonon solitons ....See Entry 72066

Impurity atom with an easy-plane anisotropy in a ferromagnet with an easy-axis anisotropy and ferromagnetic resonance ....See Entry 72599

75.50 STUDIES OF SPECIFIC MAGNETIC MATERIALS

(see also 81.40R Magnetic properties related to materials treatment)

75.50B Ferromagnetism of Fe and its alloys

Electromagnetic phenomena in solid iron ....See Entry 71056

Study by X-ray and neutron diffraction of the structure of ex-carbonyl amorphous iron ....See Entry 71880

Resistance of the amorphous magnetic alloy $Fe_{29}Ni_{49}P_{14}B_6Si_2$ as a function of temperature and stress ....See Entry 72372

Magnetic anisotropy in $(Fe,Co)_{75}Si_{15}B_{10}$ and $(Fe_{0.11}Co_{0.89})_{72}Mo_3Si_{15}B_{10}$ metallic glass ribbons, induced by constant stress and constant strain annealing ....See Entry 72597

Separation into two contributions of stress anneal induced magnetic anisotropy in metallic glass ribbons ....See Entry 72598

The Invar effect and spin fluctuations in disordered Fe_3Pt ......See Entry 72610

Observation of quantum fluctuations in FeSi ....See Entry 72611

Competing ferromagnetic and spin-glass order in a *Au*Fe alloy ....See Entry 72615

Evolution from ferromagnetism to spin-glass behavior .... See Entry 72616

Heat capacity of alloys with interacting magnetic-order parameters ....See Entry 72617

Effect of priming layer on magnetic losses in anisotropic high-permeability electrical steel ....See Entry 72632

The saturation magnetization of some substituted Fe-Si-B metallic glasses. II ....See Entry 72635

Stoner excitations in the strong itinerant amorphous ferromagnets $Fe_xNi_{80-x}BI_{18}Si_2$ and $Fe_{80}B_{20}$ ....See Entry 72637

Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy ....See Entry 72638

Structure formation in and magnetic properties of a P/M iron-chromium-cobalt alloy ....See Entry 72639

Wave optical effects in Lorentz microscopic images of magnetic domain walls ....See Entry 72646

Spontaneous volume magnetostriction in $Y(Fe_{1-x}Co_x)_2$ and $Zr(Fe_{1-x}Co_x)_2$ ....See Entry 72650

Magnetic interaction in plastically deformed $FePt_3$ alloy ....See Entry 72651

The ^{55}Mn and ^{57}Fe NMR study of FeCrMn alloys ....See Entry 72684

Determination of the ferromagnetic vacancy-formation enthalpy in α-iron by the positron method using the carbon-vacancy pair as a probe ....See Entry 72884

Characteristic martensitic transformation of the Fe-Pt disordered alloys around the γ-α phase boundary ....See Entry 73084

A study on the development of oriented 3% silicon steel ....See Entry 73110

Investigation of stresses created by electrically insulating coatings in electrical steel sheet with a ribbed texture ....See Entry 73133

75.50C Ferromagnetism of other metals

Formation process in MnBi thin films by Williams' method ....See Entry 72270

Surface magnetic structure analysis of Ni(001) by polarized electron diffraction ....See Entry 72584

Magnetic properties of bulk amorphous alloy Dy_4Co_3 ....See Entry 72586

Magnetic transition state approach to ferromagnetism of metals:Ni ....See Entry 72603

Magnetic evidence for the existence of RCo_z with $z\approx7$ (R=La, Ce, Pr and Nd) ....See Entry 72641

Nuclear magnetic resonance and relaxation in itinerant electron ferromagnet Ni_3Al ....See Entry 72692

NMR spin echoes and quadrupole effects in nickel single crystals ....See Entry 72697

Observation of spin-split electronic states in solids by energy-, angle-, and spin-resolved photoemission ....See Entry 72948

A study on electroless plating of cobalt alloy films for perpendicular recording ....See Entry 73006

75.50D Ferromagnetism of nonmetals

Superconducting and magnetic properties of ternary silicides in some rare earth-noble metal (Rh or Ir)-silicon systems ....See Entry 71942

Correlation of electrical resistivity and heat capacity of silicides of rare-earth metals with the composition R_5Si_4 ....See Entry 72402

Effect of pressure on the Curie temperature of $CuCr_2Se_{4-x}Br_x$ ....See Entry 72601

Exchange interactions in bis(diethyldithiocarbamato)copper (II), $Cu(detc)_2$ ....See Entry 72663

75.50E Antiferromagnetics

Superconducting and magnetic properties of ternary silicides in some rare earth-noble metal (Rh or Ir)-silicon systems ....See Entry 71942

Structure and magnetism in a hydroxy bridged binuclear copper(II) system with a 'tunable' binuclear centre ....See Entry 72364

A possibility of triple-Q incommensurate magnetic structure in $RbFeCl_3$-type triangular antiferromagnets ....See Entry 72581

Magnetic history of hexanediammonium tetrachloroferrate(II) .... See Entry 72585

Magnetic ordering of the intermetallic compound Gd_2Au .... See Entry 72587

Magnetic properties of the R_5Sb_3 compounds (R=La, Pr, Nd, Gd, Tb, Dy, Ho, Er, Tm and Y) .... See Entry 72588

A Mossbauer study of the variation in Neel temperature in iron-rare earth layer compounds .... See Entry 72604

Experimental curves of entropy and susceptibility versus temperature for copper nuclear spins down to the ordered state .... See Entry 72605

High-pressure and extended X-ray-absorption fine-structure study of Cr-rich Cr-Ge alloys .... See Entry 72606

Observation of quantum fluctuations in FeSi .... See Entry 72611

Heat capacity of alloys with interacting magnetic-order parameters .... See Entry 72617

Magnetic properties of $REFe_2Si_2$ compounds .... See Entry 72636

Magnetic and electronic properties of thin iron oxide films .... See Entry 72644

Magnetic interaction in plastically deformed $FePt_3$ alloy .... See Entry 72651

Muon spin rotation in antiferromagnetic oxides .... See Entry 72724

75.50G Ferrimagnetics

Boundaries of the long-wavelength part of the spin wave spectrum .... See Entry 72591

Excitation and propagation of dimensionless magnetostatic types of waves and oscillations in rectangular yttrium-iron-garnet rods .... See Entry 72594

Frequency dependent damping and stiffness of the domain walls in pure iron-deficient polycrystalline YIG .... See Entry 72631

Magnetic properties of the compound $HfFe_2Si_2$ .... See Entry 72633

Magnetic and electronic properties of thin iron oxide films .... See Entry 72644

Parametric excitation of inhomogeneous vibrations of domain walls by a high-frequency homogeneous magnetic field .... See Entry 72645

Ferromagnetic resonance in holmium-yttrium iron garnets in the Ising model .... See Entry 72680

Effect of sintering conditions on the microstructure and electromagnetic properties of Li-Mg-Mn ferrite memory elements .... See Entry 73049

Sintering of glass bonded ceramic barium hexaferrite magnetic powders .... See Entry 73059

75.50K Amorphous magnetic materials

Study by X-ray and neutron diffraction of the structure of ex-carbonyl amorphous iron .... See Entry 71880

Computer modelling of amorphous magnetic materials .... See Entry 71881

New soft magnetic materials .... See Entry 71885

Resistance of the amorphous magnetic alloy $Fe_{29}Ni_{49}P_{14}B_6Si_2$ as a function of temperature and stress .... See Entry 72372

Magnetic properties of bulk amorphous alloy Dy_4Co_3 .... See Entry 72586

Magnetic anisotropy in $(Fe,Co)_{75}Si_{15}B_{10}$ and $(Fe_{0.11}Co_{0.89})_{72}Mo_3Si_{15}B_{10}$ metallic glass ribbons, induced by constant stress and constant strain annealing .... See Entry 72597

Separation into two contributions of stress anneal induced magnetic anisotropy in metallic glass ribbons .... See Entry 72598

Phase transitions in random anisotropy magnets .... See Entry 72607

The Invar effect and spin fluctuations in disordered Fe_3Pt .... See Entry 72610

Evolution from ferromagnetism to spin-glass behavior .... See Entry 72616

Changes in the magnetic properties of amorphous alloy $Fe_5Co_{70}Si_{15}B_{10}$ caused by thermomagnetic treatment and the dependence of these changes on the initial state of alloy .... See Entry 72630

The saturation magnetization of some substituted Fe-Si-B metallic glasses. II .... See Entry 72635

Stoner excitations in the strong itinerant amorphous ferromagnets $Fe_xNi_{80-x}BI_{18}Si_2$ and $Fe_{80}B_{20}$ .... See Entry 72637

Wave optical effects in Lorentz microscopic images of magnetic domain walls .... See Entry 72646

Optical polarization of nuclear angular momenta in amorphous Si-Dy .... See Entry 72700

75.60 DOMAIN EFFECTS, MAGNETIZATION CURVES, AND HYSTERESIS

75.60C Domain walls and domain structure

(for magnetic bubbles, see 75.70K)

72630 Changes in the magnetic properties of amorphous alloy $Fe_5Co_{70}Si_{15}B_{10}$ caused by thermomagnetic treatment and the dependence of these changes on the initial state of alloy. I.B.Kekalo, V.L.Stolyarov, V.E.Taranichev, V.Yu.Tsvetkov (Inst. of Steels & Alloys, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.484-90 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The initial state of $Fe_5Co_{70}Si_{15}B_{10}$, controlled by preliminary heat treatments, exerted a strong influence on the kinetics of changes of its magnetic properties and on the degree of such changes. When the domain structure was stabilized by a preliminary heat treatment because of local directional ordering, the rate of change of B_r/B during thermomagnetic treatment was small and the value of μ_0 varied following a curve with a maximum. In the absence of domain wall stabilization the value of μ_0 decreased monotonically. The best properties were obtained by high-temperature annealing in the absence of a magnetic field and subsequent cooling in water; thermomagnetic treatment at 270°C caused deterioration of the properties. (22 refs.) *A.T.*

72631 Frequency dependent damping and stiffness of the domain walls in pure iron-deficient polycrystalline YIG. M.Guyot, T.Merceron, V.Cagan (Lab. de Magnetisme, CNRS, Meudon, France).
J. Phys. D (GB), vol.16, no.5, p.L193-6 (14 May 1983).
Very large partial relaxations due to diffusion after-effects are observed in the initial permeability frequency spectrum of undoped but slightly iron-deficient YIG polycrystals. Dynamic changes of the domain wall parameters, associated with the diffusant relaxations, are introduced to explain the observations. (8 refs.)

On the magnetic structure of a hexagonal Ising antiferromagnetic .... See Entry 72583

The magnetostatic energies of ellipsoidal particles which contain a reverse domain and a nonmagnetic inclusion .... See Entry 72640

NMR spin echoes and quadrupole effects in nickel single crystals .... See Entry 72697

Diffraction of light in magnetooptic media with a band domain structure .... See Entry 72774

Magnetic bias field generator design for the measurement of magnetic garnet film properties using Faraday rotation .... See Entry 72775

75.60E Magnetization curves, hysteresis, Barkhausen and related effects

72632 Effect of priming layer on magnetic losses in anisotropic high-permeability electrical steel. V.M.Segal, Yu.N.Starodubtsev, T.I.Prasova, M.Ya.Sokolovskii, M.B.Tsyrlin (Verkhne-Isetsk Metall. Plant, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.197-200 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1423-6 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
When the quality of the surface prior to formation of the primer layer is high, the layer exerts an overall positive effect on losses in specimens with high magnetic induction as a result of the tensile stress created by the priming layer itself. In specimens with a moderate degree of perfection of the texture (B_{2500}~1.9 T), even a not very well developed primer/metal interface has a negative effect on losses, one that cannot be compensated for by tensile stresses in this case. Moreover, in the case of a diffuse final texture, the magnetic losses of a specimen with a defect-free priming layer are degraded when tensile stresses are applied. (5 refs.)

72633 Magnetic properties of the compound $HfFe_2Si_2$. R.V.Skorozda, Yu.V.Stadnyk, Yu.K.Gorelenko, Ya.P.Yarmolyuk, S.B.Kruglyashov (Ivan Franko State Univ., Lvov, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.479-83 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An investigation was made of the magnetization, magnetic susceptibility, electrical resistivity, and thermoelectric power of $HfFe_2Si_2$ (space group Pbcm; a=0.7464 nm, b=0.7006 nm, c=0.5067 nm) at temperatures 4.2-1100K. The compound $HfFe_2Si_2$ was found to be ferrimagnetic ($T_c \approx 410K$) with different magnetic moments of the iron atoms in the 4(d) and 4(f) positions. A transition from a noncollinear to a collinear ferrimagnetic state took place at 190K. Up to 750K the paramagnetic susceptibility was described by the Neel law for a two-sublattice ferrimagnet; above this temperature there was a change in the energy band structure of the compound. (6 refs.) *A.T.*

72634 Magnetic properties of $Pr_xY_{1-x}Co_5$ and $Pr_xSm_{1-x}Co_5$ crystals. A.S.Ermolenko (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.503-9 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The magnetic moments and the angles between the easy magnetization direction and the c axis were determined for $Pr_xY_{1-x}Co_5$ single crystals at temperatures 4.2-300K. The magnetization curves in magnetic fields up to 7×10^6 A/m were determined along the *a*, *b*, and *c* axes at 4.2K. These curves were then used to find the anisotropy constants of the Pr sublattice and the molecular field of the intersublattice exchange interaction. The parameters used to calculate the magnetization curves of $Pr_xSm_{1-x}Co_5$ alloys were also determined. (11 refs.) *A.T.*

72635 The saturation magnetization of some substituted Fe-Si-B metallic glasses. II. K.Hoselitz (School of Engng. & Appl. Sci., Univ. of Sussex, Brighton, England).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.39-46 (April 1983).
For pt.I see ibid., vol.20, p.201 (1980). Variations of the magnetic moment n_B of the Fe-atom in 80-20 Fe-metalloid metallic glasses are measured. For Cu, n_B shows at first a small rise followed by a fall to a constant value. In the case of Cr, n_B at first stays constant and then decreases almost linearly. These results suggest that the magnetism of these materials is of the electron band type. (9 refs.)

72636 Magnetic properties of $REFe_2Si_2$ compounds. A.M.Umarji, D.R.Noakes, P.J.Viccaro, G.K.Shenoy, A.T.Aldred (Argonne Nat. Lab., Argonne, IL, USA), D.Niarchos.
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.61-5 (April 1983).
Structural, magnetization and Mossbauer measurements are reported on $REFe_2Si_2$ (RE=La, Ce, Nd, Gd, Er). In contradiction with earlier reports, all these compounds contain only one type of Fe atom with no magnetic moment on it. The antiferromagnetic phase of Nd, Gd and Er compounds produces hyperfine magnetic fields at half of the Fe sites and no field at the other half. This permits us to predict the antiferromagnetic structure. La and Ce compounds show weak paramagnetic behavior indicating tetravalent Ce and trivalent La atoms in these structures. (19 refs.)

72637 Stoner excitations in the strong itinerant amorphous ferromagnets $Fe_xNi_{80-x}BI_{18}Si_2$ and $Fe_{80}B_{20}$. E.Babic, Z.Marohnic (Inst. of Phys., Univ. of Zagreb, Zagreb, Yugoslavia), E.P.Wohlfarth.
Phys. Lett. A (Netherlands), vol.95A, no.6, p.335-8 (9 May 1983).
Accurate measurements of the static magnetization of the amorphous ferromagnets $Fe_xNi_{80-x}B_{18}Si_2$ (x=15, 20, 40, 60%) and $Fe_{80}B_{20}$ are reported. The results are analyzed in terms of spin-wave and Stoner excitations, and the latter indicate strong itinerant ferromagnetism with a Stoner gap Δ varying between 20 and 60K. The other fitting parameters give values of the spin-wave stiffness and a quantity simply related to the saturation magnetization. The well-known anomaly regarding the spin-wave stiffness observed in earlier measurements is thus explained quantitatively. (11 refs.)

Electromagnetic phenomena in solid iron .... See Entry 71056

Field-property bounds for porous sintered ceramics .... See Entry 72386

Magnetic properties of $Cr_{1/3}NbS_2$ .... See Entry 72582

Magnetic properties of bulk amorphous alloy Dy_4Co_3 .... See Entry 72586

Magnetic ordering of the intermetallic compound Gd_2Au .... See Entry 72587

Impurity atom with an easy-plane anisotropy in a ferromagnet with an easy-axis anisotropy and ferromagnetic resonance .... See Entry 72599

Effect of pressure on the Curie temperature of $CuCr_2Se_{4-x}Br_x$ .... See Entry 72601

Competing ferromagnetic and spin-glass order in a *Au*Fe alloy .... See Entry 72615

Frequency dependent damping and stiffness of the domain walls in pure iron-deficient polycrystalline YIG .... See Entry 72631

Spectrum of magnetization oscillations in a uniaxial ferromagnetic plate .... See Entry 72647

Magnetic interaction in plastically deformed $FePt_3$ alloy .... See Entry 72651

Approximate theory of FMR and AR in weakly conducting ferromagnetic bulk metals .... See Entry 72679

Effect of sintering conditions on the microstructure and electromagnetic properties of Li-Mg-Mn ferrite memory elements .... See Entry 73049

Characteristic martensitic transformation of the Fe-Pt disordered alloys around the γ-α phase boundary .... See Entry 73084

A study on the development of oriented 3% silicon steel .... See Entry 73110

75.60G High coercivity materials

72638 Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy. Tang Di-sheng, Zhang Yu-ling, Yi Sun-Sheng, Lin Wen-Gui, Li Guo-Dong (Inst. of Phys., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.9-13 (Jan.-March 1983). [received: May 1983]
A fabricable permanent magnetic alloy, with composition of 62Fe-23Cr-15Co (in wt.%) has been studied by a high-temperature X-ray diffraction method. Debye-Scherrer photographs of samples treated with aging in a magnetic field and also of those treated without a magnetic field were taken. It has been observed that the transformation process with rising temperature up to 800°C is different in the two classes of samples. The lattice parameters of the samples without a treatment in a magnetic field have been measured at various temperatures, and it has been found that in these samples a transitional phase unknown before appeared at 610°C, which was unstable at other temperatures. (8 refs.)

72639 Structure formation in and magnetic properties of a P/M iron-chromium-cobalt alloy. Yu.G.Dorofeev, V.V.Kulikov, B.P.Adrianovskii (Novocherkassk Polytech. Inst., USSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.734-6 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.60-3 (Sept. 1982). [received: March 1983]
A study was made of the dependence of the processes of structure formation in a P/M iron-chromium-cobalt alloy on heat treatment conditions. Optimum magnetic properties were attained after 3-h sintering at a temperature of 1290 ± 10°C, TMT, and stepwise tempering. It is concluded that the alloy investigated and the process developed can be employed for the industrial manufacture of permanent magnets. (5 refs.)

75.60J Fine-particle systems

72640 The magnetostatic energies of ellipsoidal particles which contain a reverse domain and a nonmagnetic inclusion. J.E.Coleman (Dept. of Appl. Phys., Conventry Lanchester Polytech., Coventry, England).
J. Phys. D (GB), vol.16, no.5, p.909-13 (14 May 1983).
A superposition method is used to obtain expressions for the changes of magnetostatic energy when a reverse domain is formed either adjacent to or surrounding a nonmagnetic inclusion. It is shown that such inclusions may lower the energy barriers to the nucleation of reverse domains and may also hinder the achievement of true saturation. (2 refs.)

72641 Magnetic evidence for the existence of RCo_z with $z \approx 7$ (R=La, Ce, Pr and Nd). H.O.Gupta, W.E.Wallace, R.S.Craig (Dept. of Chem., Univ. of Pitsburgh, Pittsburgh, PA, USA).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.95-7 (April 1983).
RCo_5 alloys (R=La, Ce, Pr, Nd, Sm and Y) in fine particle form were examined magnetically. The cast materials were observed to develop additional phases during comminution by ball milling. The compositions of the phases were inferred from the measured Curie temperatures. A component having a Curie temperature between those of RCo_5 and R_2Co_{17} was present in the fine powders and was identified as R_3Co_{22} or R_4Co_{27}. A component in the La-Co system having $T_c \approx 825$°C was identified as La_2Co_{17}. The R_3Co_{22}, R_4Co_{27} and La_2Co_{17} compounds, which have not been reported previously, are apparently formed from the RCo_5 compounds during the comminution process. There is no evidence of the formation of these phases for R=Rm or Y. (6 refs.)

72642 Superparamagnetism in γ-Mn_2O_3-α-Fe_2O_3-α-Mn_2O_3 system. B.Banerjee, S.Lahiry (Dept. of Chem., Univ. of Delhi, Delhi, India).
Phys. Status Solidi a (Germany), vol.76, no.2, p.683-94 (16 April 1983).
Superparamagnetism is observed in the mixed system, γ-Mn_2O_3-α-Fe_2O_3-α-Mn_2O_3 prepared by ceramic technique and the salient characteristics of a superparamagnetic substance are studied. The magnetic granulometry method (Langevin function) is employed to derive useful results like particle diameter (lying between 100 to 150 Å), number of particles per gram, magnetic moment per particle, and number of unique atoms per particle (N). These samples obey a $CaN^{0.56 \text{ to } 0.60}$ relationship. Following Neel's criterion of a superparamagnet, the particle diameters are expected to be above 100 Å. X-ray line broadening method yields a diameter of 150 Å, while electron micrographs show agglomeration of the particles. Neither γ-Mn_2O_3 nor α-Fe_2O_3 nor α-Mn_2O_3 itself, under identical preparation conditions, exhibit superparamagnetism like the mixed system, γ-Mn_2O_3-αFe_2O_3-α-Mn_2O_3. (31 refs.)

Study by X-ray and neutron diffraction of the structure of ex-carbonyl amorphous iron .... See Entry 71880

The mechanism of the surface stabilization of CrO_2 magnetic powders .... See Entry 72190

75.60L Magnetic aftereffects

Frequency dependent damping and stiffness of the domain walls in pure iron-deficient polycrystalline YIG .... See Entry 72631

75.60N Magnetic annealing and temperature-hysteresis effects

Magnetic anisotropy in $(Fe,Co)_{75}Si_{15}B_{10}$ and $(Fe_{0.11}Co_{0.89})_{72}Mo_3Si_{15}B_{10}$ metallic glass ribbons, induced by constant stress and constant strain annealing .... See Entry 72597

Separation into two contributions of stress anneal induced magnetic anisotropy in metallic glass ribbons .... See Entry 72598

Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy .... See Entry 72638

75.70 MAGNETIC FILMS AND PLATES

72643 The magnetic contribution to specific heat in thin ferromagnetic films. L.Wojtczak, A.Urbaniak-Kucharczyk (Inst. of Phys., Univ. of Lodz, Lodz, Poland), J.Mielnicki, B.Mrygon.
Phys. Status Solidi a (Germany), vol.76, no.1, p.113-20 (16 March 1983).
The magnetic contribution to the specific heat of thin ferromagnetic films is discussed. The numerical calculations made for the special case of SC crystallographic lattice and $S=1/2$ reveal that the specific heat is larger in thin films than in bulk material, contrary to the behaviour of other properties, e.g. magnetization or electrical resistivity. (5 refs.)

72644 Magnetic and electronic properties of thin iron oxide films. M.Domke, B.Kyvelos, G.Kaindl (Freie Univ. Berlin, Berlin, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.727-32 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Conversion electron Mossbauer spectroscopy (CEMS) with the 14.4 keV gamma resonance of ^{57}Fe was employed to study uncovered 5 to 50 Å thick iron oxide films grown on single-crystal Fe(110) and Fe(100) substrates under UHV conditions. For both magnetite (Fe_3O_4) and hematite (α-Fe_2O_3) a decrease of the magnetic hyperfine field and of the Mossbauer isomer shift was observed at room temperature with film thicknesses smaller than 20 Å. In addition, the magnetization vector was found to align preferentially normal to the surface with decreasing thickness of the oxide films. (16 refs.)

Formation process in MnBi thin films by Williams' method .... See Entry 72270

Dependence of the magnetoresistance on dispersion properties of Permalloy films with allowance for the angular spatial dispersion of the anisotropy .... See Entry 72518

Spectrum and damping of spin waves in size-quantized ferromagnetic semiconductor films .... See Entry 72590

A study on electroless plating of cobalt alloy films for perpendicular recording .... See Entry 73006

75.70K Domain structure (magnetic bubbles)

72645 Parametric excitation of inhomogeneous vibrations of domain walls by a high-frequency homogeneous magnetic field. D.I.Sirota, N.P.Kolmakova, L.V.Vasilevskaya (Inst. of Transport Machine Construction, Bryansk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.607-9 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
It is shown theoretically that, above a certain threshold value, a high-frequency homogeneous magnetic field can excite inhomogeneous vibrations at half the frequency of an alternating magnetic field. This theoretical analysis accounts for the reported experimental observation of such vibrations in $(YGd)_3(FeGa)_5O_{12}$ films. (9 refs.) *A.T.*

72646 Wave optical effects in Lorentz microscopic images of magnetic domain walls. S.Tsukahara, H.Kawakatsu (Electrotech. Lab., Ibaraki, Japan).
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.98-110 (April 1983).
Intensity distributions in Lorentz microscopic defocused images of magnetic domain walls were numerically calculated using wave optics. Constants used in the calculation were generalized by the deflection angle ϕ and the wall width $2x_0$ so that the result was able to apply to any magnetic films. 180° walls in amorphous Gd-Fe films were observed by transmission Lorentz microscopy operating at 200 kV in the defocused mode. Numbers of well resolved interference fringes were apparently observed in convergent images when the illumination angle was kept less than about 2×10^{-6} and their intensity varied in consistent way to the calculated images with the defocusing distance. Series of convergent images of each wall were compared with the calculated ones by a through focus fitting method and the deflection angle and the wall width were accurately determined at a time. The measured example for a Gd-Fe film of 510 Å in thickness was $\phi=2.65 \times 10^{-5}$ and $2x_0=1320$ Å. (22 refs.)

72647 Spectrum of magnetization oscillations in a uniaxial ferromagnetic plate. Yu.I.Bespyatykh, I.E.Dikshtein, S.V.Meriakri, V.V.Tarasenko (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Phys. Status Solidi b (Germany), vol.116, no.2, p.607-16 (1 April 1983).
A theoretical investigation is made for the ground state of a ferromagnetic plate in the vicinity of the Curie temperature in a normal magnetic field. It is shown that there can exist either a uniform magnetic state, a strip domain structure, or a hexagonal domain lattice depending on the temperature and the magnetic field. The spectrum of magnetization oscillations in each of the possible states is calculated and the stability regions of different phases are determined. The results are generalized for orientational phase transitions in the uniaxial ferromagnetic plate in a oblique magnetic field. (6 refs.)

72648 Measurement of magnetic bubble domain wall energy density. J.C.Cho (Dept. of Electrical & Computer Engng., Louisiana State Univ., Baton Rouge, LA, USA).
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.31-5
Magnetic bubble domain wall energy density was determined by data of measurement of zero field total stripe width, bubble collapse field and collapse diameter. Energy density was also determined by use of material length calculation. Comparing the two methods, the difference is about 5%. (4 refs.)

75.80 MAGNETOMECHANICAL AND MAGNETOELECTRIC EFFECTS, MAGNETOSTRICTION

72649 Magnetostriction of austenite in iron-nickel-manganese alloys and martensitic transition under the action of a strong magnetic field. I.V.Zolotarevskii, V.L.Snezhnoi, L.M.Sheiko (Pedagogical Inst., Zaporozhye, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.548-53 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the bulk magnetostriction of $Fe_{70+x}Ni_{30-2x}Mn_x$ alloys in the paraprocess region (up to 18-24 kOe). It was found that in the case of N24G3 alloys ($x \approx 3$) the magnetostriction of austenite measured at 77K was of the same order of magnitude as the magnetostriction of N30 alloys ($x=0$) at $T=295K$. An estimate was obtained of the bulk deformation of austenite in the investigated alloys near the martensitic point of the athermal reaction in strongly magnetic fields (100-300 kOe). The shift of the martensitic point under the action of strong magnetic fields was attributed not only to the difference between the magnetizations of the γ- and α-phases, but also to the difference between their bulk magnetostrictions. (20 refs.) *A.T.*

72650 Spontaneous volume magnetostriction in $Y(Fe_{1-x}Co_x)_2$ and $Zr(Fe_{1-x}Co_x)_2$. K.Terao, M.Shimizu (Dept. of Appl. Phys., Nagoya Univ., Nagoya, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.111-14 (18 April 1983).
The spontaneous volume magnetostriction is calculated for $Y(Fe_{1-x}Co_x)_2$ and $Zr(Fe_{1-x}Co_x)_2$ in the simple itinerant-electron model. The density of states for various compositions is calculated by the recursion method. The calculated results on the composition dependence of the spontaneous volume magnetostriction are shown to be consistent with the experimental ones. (15 refs.)

72651 Magnetic interaction in plastically deformed $FePt_3$ alloy. S.Takahashi, K.Ikeda (Faculty of Engng., Iwate Univ., Morioka, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.247-8 (2 May 1983).
The transition from antiferromagnetic to ferromagnetic coupling by plastic deformation in $FePt_3$ alloy is explained in terms of the dislocation theory with consideration of ferromagnetic and antiferromagnetic Fe-Fe interactions. (5 refs.)

Influence of the magnetic field on the phase velocities of surface and volume waves in a perfectly conducting regular layered medium ....See Entry 71456

Elastic and magnetoelastic effects in $TmAl_2$ and other $REAl_2$ compounds ....See Entry 72030

Effect of pressure on the Curie temperature of $CuCr_2Se_{4-x}Br_x$ ....See Entry 72601

High-pressure and extended X-ray-absorption fine-structure study of Cr-rich Cr-Ge alloys ....See Entry 72606

Effect of priming layer on magnetic losses in anisotropic high-permeability electrical steel ....See Entry 72632

Characteristic martensitic transformation of the Fe-Pt disordered alloys around the γ-α phase boundary ....See Entry 73084

Investigation of stresses created by electrically insulating coatings in electrical steel sheet with a ribbed texture ....See Entry 73133

75.90 OTHER TOPICS IN MAGNETIC PROPERTIES AND MATERIALS

72652 Retarded surface modes in an antiferromagnet. F.A.Oliveira (Inst. de Fisica, Univ. Federal Fluminense, Rio de Janeiro, Brazil).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.245-6 (2 May 1983).
The author obtains the dispersion relation for the retarded surface modes in an antiferromagnet for a general propagation direction. (11 refs.)

72653 Ortho-para conversion of hydrogen molecules on magnetic surfaces. Y.Ishii, S.Sugano (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Surf. Sci. (Netherlands), vol.127, no.1, p.21-34 (April 1983).
The theory of the ortho-para conversion of a hydrogen molecule on magnetic surfaces, involving two paths of energy flow into the translational motion of the molecule and the excitation of the substrate spins, is formulated in a compact form to compare with the experimental results of an antiferromagnet, α-Cr_2O_3, and a ferromagnet, EuO. The enhancement of the conversion rate near the critical temperature for α-Cr_2O_3 and the absence of the enhancement for EuO are explained in a semi-quantitative way. (11 refs.)

76.00 MAGNETIC RESONANCES AND RELAXATION IN CONDENSED MATTER; MÖSSBAUER EFFECT

(for measurement techniques, see 07.58)

76.20 GENERAL THEORY OF RESONANCES AND RELAXATION

72654 Theory of spin relaxation in metals. Relaxation time maximum at low temperatures. F.Shibata, Y.Hamano (Dept. of Phys., Ochanomizu Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1410-19 (April 1983).
A general theory of spin relaxation in metals is developed: it is valid for any temperature domain and also for arbitrary magnitude I of a relevant nuclear spin. A multiple-time relaxation process for $I \geq 1$ is completely determined on a microscopic scale. Though the multiple character of the relaxation process for the first moment reveals itself only at low temperatures and/or high magnetic field, it is essential for the fluctuations even in the high temperature domain. At very low temperatures, the relaxation times saturate in contrast to behaviours given by the Korringa relation and a new phenomenon 'relaxation-time-maximum' is found as a function of inverse temperature. A discussion is given to the related experiments. Effects of spin wave excitations on the relaxation process are also discussed. (24 refs.)

72655 Analysis of magnetic resonance line shape under slow molecular motions. N.A.Sergeev, D.S.Ryabushkin (M.V. Frunze State Univ., Simferopol, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.624-7 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.48-52 (July 1982). [received: May 1983]
A new approach is considered to the analysis of the magnetic resonance line shape under slow molecular motions. The essence of the approach consists in calculating the coefficients a_n in the Taylor expansion G(t). A straightforward procedure has been developed for calculating the coefficients a_n for molecular motions described by random Markov processes. (20 refs.)

72656 Different averaging methods in magnetic-resonance theory. L.L.Buishvili, G.V.Kobakhidze, M.G.Menabde (Phys. Inst., Acad. of Sci., Georgian SSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.347-9 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.628-33 (Aug. 1982). [received: May 1983]
The causes of the discrepancy between J. Waugh's mean Hamiltonian theory based on the Magnus expansion, on the one hand, and the averaging method, on the other, are considered. It is shown that the contributions to the line width from the main line and from the satellite are not separated; in a number of cases this is the cause of the discrepancy between the Waugh theory and the experimental data. The general results are illustrated for the case of a two-level system located in a linearly polarized alternating field (the Bloch-Siegert shift). (9 refs.)

76.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

72657 Simulation of electron spin resonance spectra by fast Fourier transform. J.C.Evans, P.H.Morgan (Dept. of Chem., Univ. Coll. Cardiff, Cardiff, Wales).
J. Magn. Resonance (USA), vol.52, no.3, p.529-31 (May 1983).
Brumby (see ibid., vol.40, p.397 (1980)) has criticized the paper by Evans et al. (see Anal. Chim. Acta. vol.103, p.175 (1978)) on the simulation of EPR spectra and has drawn attention to several points which he believes are unsatisfactory. The 1978 paper describes not only the application of a novel technique of using Fourier transform methods to include time constants and modulation broadening, but also describes their use to simulate spectra from polycrystalline samples and those involving isotopic substitution which has not been done before. The authors purpose is to answer the various points raised by Brumby and to point out a serious error in his paper. (7 refs.)

72658 ESR in the two phases of the magnetic semiconductor $GaCr_4S_8$. P.Huguet, G.Alquie (Lab. de Dispositifs Infrarouge et de Resonance Magnetique, Univ. Pierre et Marie Curie, Paris, France), M.Potel, M.Sergent.
J. Phys. Lett. (France), vol.44, no.10, p.L393-401 (15 May 1983).
Presents new results obtained from ESR experiments in the paramagnetic and magnetically ordered states of both crystallographic phases of the magnetic semiconductor $GaCr_4S_8$. The authors observe a critical behaviour typical of magnetic phase transitions, resulting in a shift and a broadening of the resonance line as well as a distortion of its shape. These features are discussed and related to the presence of magnetization fluctuations. (16 refs.)

72659 Anomalous relaxation in low-dimensional magnets with anisotropic interactions. H.Okamoto, H.Mori (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.255-8 (2 May 1983).
Anomalies of the angle-dependent EPR line spectrum and its satellites due to the long-time tails in one- and two-dimensional Heisenberg paramagnets with anisotropy terms are treated in the high-temperature limit by making use of a new mode-coupling theory. A normal lorentzian EPR line spectrum is also expected for some particular combinations of the anisotropic interaction parameters due to the competition between them. (11 refs.)

Possibility of carrying out field-free paramagnetic resonance by the two-frequency method ....See Entry 70094

New possibility for EPR studies by laser polarimetry ....See Entry 72713

Mechanism of hydrogen atom decay in γ-irradiated sulfuric acid glasses ....See Entry 73352

76.30D Ions and impurities: general

72660 Theoretical study of the dynamic effect caused by low-symmetric distribution of spins on EPR spectra in one-dimensional systems by the method of memory function. Y.Natsume, F.Noda (Dept. of Phys., Chiba Univ., Chiba, Japan), F.Sasagawa, H.Kanazawa.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1427-33 (April 1983).
The fact that the low-symmetric distribution of spins causes the prominent effect on EPR spectra in exchange-interacting one-dimensional paramagnets is verified by a theoretical study on the basis of Mori's memory function method. The characteristic contribution from this effect, which vanishes completely in cases for the high-symmetric distribution of spins, is taken into account in the derivation of spectral function. Obtained spectra depend, in consequence, on the relation between the directions of one-dimensional chain-axis and vibrational field, as well as on that of chain-axis and static field. Characteristic features of the spectra (distortions of lineshape, linewidths and shifts of resonance field) agree well with those of observations in $(CH_3)_4NMnCl_3$ (TMMC). (19 refs.)

72661 EPR spectroscopy of single crystals using a two-circle goniometer. J.R.Morton, K.F.Preston (Div. of Chem., Nat. Res. Council, Ottawa, Ontario, Canada).
J. Magn. Resonance (USA), vol.52, no.3, p.457-74 (May 1983).
The anisotropy of EPR spectra observed in single crystals of various symmetry classes is described. The use of a computer-assisted goniometer to assemble the hyperfine-interaction and g^2 tensors in the crystallographic axis system is explained. (17 refs.)

76.30F Iron group (3d) ions and impurities (Ti-Cu)

72662 Influence of iron concentration and particle size on the ESR linewidth of Al_2O_3:Fe^{3+} powders. R.S.De Biasi, D.C.S.Rodrigues (Secao de Engenhario e Ciencia dos Materiais, Inst. Militar de Engenharia, Rio de Janeiro, Brazil).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.210-12 (May 1983).
The influence of Fe concentration and particle size on ESR linewidth was studied and it was found that the linewidth increased with increasing Fe concentration and decreased with increasing particle size. (2 refs.)

72663 Exchange interactions in bis(diethyldithiocarbamato)copper (II), $Cu(detc)_2$. B.L.Ramakrishna, P.T.Manoharan (Dept. of Chem., Indian Inst. of Technol., Madras, India).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.98-102 (6 May 1983).
The exchange coupling constant J in bis (diethyldithiocarbamato)copper (II) has been derived through analysis of the EPR g values and linewidth as a function of orientation, frequency and temperature. The single line in the *ac* plane is due to the averaging of the fine-structure splitting by interdimer exchange for which a lower limit of 0.02 cm^{-1} has been obtained. Analysis of

the spectra of the *bc* plane gives an estimate of 0.008 cm^{-1} for the intersite exchange. (17 refs.)

72664 Effect of quenching rate and annealing on ESR of Cu^{2+} and γ-induced Cd^{+} in low alkali borate glasses. H.Hosono, H.Kawazoe, T.Kanazawa (Dept. of Industrial Chem., Tokyo Metropolitan Univ., Tokyo, Japan).

J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.3-14 (April 1983).

A new ESR hyperfine structure (HFS) of Cu^{2+} was detected in moderately (cooling rate $\approx$3 K/s) and rapidly (10^3-10^5 K/s) quenched borate glasses with Na_2O content smaller than 5 mol.% in addition to the already reported three patterns, spectra I, II and III, for the moderately quenched borate glasses with $5 \lesssim [Na_2O] \lesssim 13$, $20 \lesssim [Na_2O] \lesssim 37$ and $55 \lesssim [Na_2O] \lesssim 75$, respectively. The ESR parameters of this spectrum were much the same as those of II, but a significant difference was observed between thermal stabilities of these spectra. The newly observed spectrum was named spectrum II′. A superposition of spectra II′ and I was seen in low alkali borate glasses ($[Na_2O] \lesssim 5$ mol.%). The relative intensity of II′ to I increased remarkably with increasing quenching rate of the melts and with decreasing alkali content under the same quenching condition. In addition, spectrum II′ was found to relax into I upon thermal annealing of the glasses. Similar changes were observed also in ESR of the γ-induced Cd^{+} with $5s^1$ electronic configuration. A tentative model to account for the spectral changes was proposed on the basis of the characteristics of B-O bonding. (24 refs.)

72665 State of Fe^{3+} ion and Fe^{3+}-F^{-} interaction in calcium fluorosilicate glasses. N.Iwamoto, Y.Makino (Welding Res. Inst., Osaka Univ., Osaka, Japan), S.Kasahara.

J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.113-24 (April 1983).

The state of Fe^{3+} ions and Fe^{3+}-F^{-} interaction in calcium fluorosilicate glasses $xCaF_2.(1-x)CaO.SiO_2$ $(0 \leq x \leq 0.3)$ containing a small amount of iron were investigated by ESR spectroscopy. Two resonances observed near $g=2.0$ and $g=4.3$ were assigned to dipole-dipole interacted Fe^{3+} ions and Fe^{3+} ions in a rhombic crystal field, respectively. The fraction of Fe^{3+} ions in a rhombic crystal field decreased and that of dipole-dipole interacted Fe^{3+} ions in a rhombic crystal field decreased and that of dipole-dipole interacted Fe^{3+} ions increased with increasing Fe_2O_3 content. It was found that the quantity of dipole-dipole interacted Fe^{3+} ions depends on the negative partial charge of fluorine ions and shows a maximum at 10 mol.% CaF_2 $(x=0.2)$. The maximum is attributed to the largest difference between absolute values of the ionic potentials of ferric and fluorine ions which is caused by the smallest negative partial charge of fluorine at 10 mol.% CaF_2. (23 refs.)

72666 Asymmetric lines in field-swept EPR: Cr^{3+} looping transitions in ruby. J.R.Pilbrow, G.R.Sinclair, D.R.Hutton, G.J.Troup (Dept. of Phys., Monash Univ., Clayton, Victoria, Australia).

J. Magn. Resonance (USA), vol.52, no.3, p.386-99 (May 1983).

Electron paramagnetic resonance is almost always observed using fixed-frequency, field-swept spectrometers. At a fixed frequency ν_c the spectral response for transitions between states i and j in field-swept EPR can be written $S(B)=C'|V_{ij}(B)|^2 f(\nu_c - \nu_0(B), \sigma_\nu)$ where C' is an appropriately defined constant at given frequency and temperature, B the applied swept magnetic field, $V_{ij}(B)$ the transition matrix element, f the lineshape function, and σ_ν the frequency domain linewidth. When $S={}^3/_2$, appropriate pairs of non-crossing levels, whose spacings vary nonlinearly with B, give rise to pairs of asymmetric transitions which coalesce at a particular angle from the crystal symmetry axis. These transitions, sometimes referred to as 'looping' transitions, form a convenient basis for a discussion of asymmetric lineshapes in EPR. Experimental spectra showing such transitions have been observed at ~9.5, 4, and 3 GHz for Cr^{3+} ions in ruby single crystals. These are well simulated by theoretical first-derivative field-swept spectra obtained by a point-by-point numerical calculation of $dS(B)/dB$. Frequency-domain Gaussian shape functions f were generally satisfactory, but pseudo-Gaussians with an adjustable exponent $\alpha \leq 2$ were sometimes required. (24 refs.)

72667 ESR of Fe^{3+} centers in $Na_3H(SO_4)_2$ crystals. K.Subba Ramaiah, C.Ramasastry (Dept. of Phys., Indian Inst. of Technol., Madras, India).

Spectrochim. Acta Part A (GB), vol.39A, no.5, p.457-61 (1983).

ESR studies of Fe^{3+} centers in $Na_3H(SO_4)_2$ crystals revealed that the sodium ion vacancies are the charge compensating vacancies. Fe^{3+} ion is trapped at two physically distinct sites and the overall symmetry is not much affected due to the charge compensating vacancies. The data are fitted to the most general spin Hamiltonian by the method of least squares and the spin Hamiltonian parameters are reported. (12 refs.)

72668 Nature of the anisotropy of the spin-spin interaction of Co^{2+} ions in $A_2Zn(ZrF_6)_2.6H_2O$ crystals. V.K.Voronkova, V.E.Petrashen', Yu.V.Yablokov, R.L.Davidovich (Physicotech. Inst., Acad. of Sci., Kazan, USSR).

Sov. Phys.-Solid State (USA), vol.24, no.10, p.1772-3 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3130-3 (Oct. 1982). [received: April 1983]

To discover the factors which determine the anisotropy of the exchange parameters, it is important to trace the trends of the changes in the anisotropy of the spin-spin interaction upon small changes in the symmetry of the ligand field in the nearest neighborhood of the Co^{2+} ion. Such small changes in symmetry are most effectively realized within a single isostructural series of crystals. The authors have studied the ESR spectra of single Co^{2+} ions and Co^{2+}-Co^{2+} pairs in the compounds $A_2Zn_{1-x}, Co_x(ZrF_6)_2.6H_2O$ (x=0.01, 0.1), A=Rb, Cs, NH_4, which are isostructural[3] with $K_2Zn(ZrF_6)_2.6H_2O$, having space group $P2_1/c$, z=2. (7 refs.)

Interaction of radiation defects with iron impurities in GaAs crystals ....See Entry 72003

Ternary copper oxides with the rutile structure: the compounds $Ti_{1-x}Cu_{x/3}Nb_{2x}/_3O_2$ ....See Entry 72391

76.30K Rare-earth ions and impurities

72669 ESR study on impurity-vacancy aggregation in Eu^{2+} doped and (Eu^{2+}, M^{2+}) doped KCl. K.Kawano, R.Nakata, M.Sumita (Univ. of Electro-Communications, Tokyo, Japan).

J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1402-9 (April 1983).

The aggregates of Eu^{2+} ions doped singly or doubly with M^{2+}(M=Sr, Ca, Cd) in KCl are investigated during the aging process of quenched crystals with ESR at 10, 24 and 34 GHz. New ESR spectra are found corresponding to the aggregation stages in KCl: (Eu^{2+}, Sr^{2+}). At 200 to 500 hours after quenching, the ESR signal due to Eu^{2+} in a cubic field appears with the values of $g=2.002$, $A^{151}=-32.0\times10^{-4}$ cm^{-1} and $b_4{}^0=25.9\times10^{-4}$ cm^{-1}, respectively. The spectrum for the final aggregation stage for 1000 hours is accounted for by assuming M^{2+}-vacancy clusters containing several Eu^{2+}-vacancy dipoles and $g=1.990$ and $b_2{}^0=620\times10^{-4}$ cm^{-1}, $A^{151}=-32.4\times10^{-4}$ cm^{-1} are determined. After further annealing, a broad line with a line width of about 500 oersted appears as the result of the exchange interaction. (21 refs.)

72670 Electron-spin-resonance of some rare-earth ions in cubic intermetallic compounds ($AuCu_3$-structure). T.Gambke, B.Elschner, R.Kremer, M.Schanz (Inst. fur Festkorperphys., Tech. Hochschule Darmstadt, Darmstadt, Germany).

J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.115-24 (April 1983).

The authors report on the ESR of Gd^{3+}, Er^{3+} and Yb^{3+} in MPd_3 (M=Sc, Y, La, Ce, Lu) and $CeRh_3$ intermetallic compounds. X-band (9.3 GHz) measurements were carried out between 0.6 and 40K. Below $T=1.6$K they used their new continuously working He^3 cryostat. The Gd resonance in $ScPd_3$ and YPd_3 shows a weak bottleneck behaviour. In $CePd_3$ the Er resonance was identified as a Γ_7 ground state with a g-value of 6.78. In $ScPd_3$ and YPd_3 they found a Γ_6 ground state for Er possibly affected by a near lying Γ_8 anisotropic quartet and a Γ_7 excited crystal field level for Er^{3+} in $ScPd_3$ and YPd_3. The Yb resonance was to be seen in all MPd_3 and in $CeRh_3$ with Γ_7 ground state. In order to extract the linewidth data, a detailed analysis of the Yb^{3+} resonance spectra has been carried out taking into account both Yb isotopes 171 and 173. Third order corrections for determining the hyperfine constant of Yb 171 became important. The g-shift of all Yb resonance in MPd_3 is the same within the error bars, whereas the linear part of the temperature dependence of linewidth (Korringa slope) scales with the markedly different Pauli susceptibilities. An exponential contribution to the temperature dependence of linewidth in all measured compounds is observed at temperature $T>6$K and is related to direct relaxation of the 4f-momentum via the host phonons (Orbach process). (39 refs.)

72671 Γ_6-ground state resonance in (La, Er)B_6 single crystals. H.Luft, K.Baberschke (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany), K.Winzer.

Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.186-90 (25 April 1983).

The ESR on cubic (La, Er)B_6 single crystals at three frequencies (4, 9 and 35 GHz) reveals unambiguously a Γ_6 as the Er^{3+} ground state with an excited Γ_8 at 8.5±1K, equivalent to a negative cubic crystal field parameter $A_4\langle r^4\rangle$. The g-shift of $\Delta g=-0.075\pm0.025$ implies a negative effective exchange coupling of $J_{\Delta g}.N(E_F)=-0.075\pm0.025$, whereas the thermal line broadening yields $|J_{\Delta H}.N(E_F)|=0.029\pm0.002$. (15 refs.)

Studies of EPR, spin, and phonon kinetics in parametic ionic crystals using Mandel'shtam-Brillouin and Raman scattering of light ....See Entry 72817

76.30L Other ions and impurities

(for colour centres, see 76.30M)

Effect of quenching rate and annealing on ESR of Cu^{2+} and γ-induced Cd^{+} in low alkali borate glasses ....See Entry 72664

Spectroscopic studies of 450°C thermal donors in silicon ....See Entry 72842

76.30M Colour centres and other defects

Optical polarization of nuclei and ESR in irradiation silicon .. See Entry 72703

76.30P Conduction electrons

72672 Population inversion in the spin states of photoelectrons and the spin-lattice relaxation in narrow-gap semiconductors. V.S.Vikhnin.

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.34-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.452-4 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).

The contribution of band states to spin-lattice relaxation in narrow-gap semiconductors is discussed. It is shown that population inversion in the spin states of conduction electrons and the maser effect in graded-gap semiconductors are possible. (1 ref.)

76.30R Free radicals

72673 ESR effects of singlet-triplet mixing in radical pairs. Determination of the individual g tensors and the exchange coupling constant from spectral shifts due to off-diagonal Zeeman terms. J.R.Byberg, N.Bjerre (Dept. of Chem., Aarhus Univ., Aarhus, Denmark), A.Lund, P.-O.Samskog.

J. Chem. Phys. (USA), vol.78, no.9, p.5413-19 (1 May 1983).

ESR spectra of exchange-coupled radical pairs exhibit shifts in the fine structure splitting proportional to the square of the microwave frequency ν_0 and shifts in the hyperfine splittings proportional to ν_0, provided the g tensors of the members of the pairs are nonequivalent. These shifts stem from electronic Zeeman terms in the full spin Hamiltonian of the pairs, which tend to mix the singlet and triplet electron spin states. Expressions for the shifts are derived from a second order perturbation calculation based on the conventional triplet description. The results are employed to obtain the individual g tensors and the exchange coupling constant for a radical pair formed by X irradiation at 26K of pentaerythritol crystal. (6 refs.)

76.40 DIAMAGNETIC AND CYCLOTRON RESONANCES

72674 Electromagnetic excitations in noble metals. V.Ya.Demikhovskii, S.S.Savinskii (Fiftieth Anniversary of the Soviet Union Udmurt State Univ., Izhevsk, USSR).

Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.433-40 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*

Numerical calculations are made of the cyclotron masses, average velocities of carriers, and Fourier components of these velocities on cyclotron orbits in noble metals. In these calculations the Fermi surface is specified analytically and five fitting parameters (deduced from the de Haas-van Alfven effect) are employed. Data are given on the spectrum and damping of helicons and Ag and Cu for the case when $\mathbf{H}\|C_4$. The local conductivity is calculated numerically for high frequencies in the range $\omega\sim\omega_c$. It is shown that near the first cyclotron resonance associated with the 4R hole orbits there is a cyclotron wave with $\mathbf{q}\perp\mathbf{H}$ and an 'anisotron' wave with $\mathbf{q}\|\mathbf{H}$. The anisotron spectra are found in the long-wavelength limit for silver and copper in the $\mathbf{H}\|C_4$ case. (8 refs.) *A.T.*

72675 Cyclotron resonance of a polaron. M.Saitoh (Cavendish Lab., Univ. of Cambridge, Cambridge, England).

J. Phys. A (GB), vol.16, no.8, p.1795-808 (1 June 1983).

The theory of the mass shift and the linewidth of the cyclotron resonance of a polaron is given. The lineshape function which was obtained earlier by the author on the basis of the path-integral method with an optimised model is utilised. This formula has the particular advantage of being applicable on a unified footing to electron-photon interactions of any strength, elastic or inelastic. Applications are made to the Frohlich polaron system and explicit analytical expressions are obtained for the first time for some limiting cases of interest. (29 refs.)

72676 Critique of the theories of cyclotron resonance lineshape. Sang Don Choi, Ok Hee Chung (Dept. of Phys., Kyungpook Nat. Univ., Taegu, South Korea).
Solid State Commun. (USA), vol.46, no.4, p.355-7 (April 1983).
Argyres-Sigel's critique (1974) of the theories of cyclotron resonance lineshape obtained by Kawabata (1967)and by Łodder and Fujita (1968) is reviewed. All the higher order terms in the expansion of the lineshape functions are proved to be finite at the resonance peaks as well as in the wings of the absorption lines, implying that the critique is unreasonable. (9 refs.)

72677 Cyclotron resonance in a degenerate plasma of a semiconductor with a superlattice. V.A.Lykakh, A.P.Tetervov (Inst. of Semiconductor Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1358-60 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2105-9 (Dec. 1982). [received: May 1983]
An analysis is made of the characteristics of cyclotron absorption in a degenerate plasma of a semiconductor with a one-dimensional superlattice, subjected to crossed static fields. It is shown that characteristics of the electron distribution function and the nonparabolicity of the electron spectrum have the effect that the cyclotron resonance can be observed only in a certain range of frequencies of an external electromagnetic field. (5 refs.)

76.50 FERROMAGNETIC, ANTIFERROMAGNETIC, AND FERRIMAGNETIC RESONANCES; SPIN WAVE RESONANCE

(see also 75.30D Spin waves)

72678 Spin wave resonance in ferromagnets with dislocations forming a periodic layered structure. W.Schmidt (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.497-506 (April 1983).
The influence of dislocations forming a periodic layered structure on the ferromagnetic resonance has been studied. A dislocation distribution function within a layer has been taken as constant while signs of dislocations in neighbouring layers are opposite. Expressions for frequencies and intensities for both quasiuniform and space modes have been found. The gap between the quasiuniform and space modes is considerable. The space mode shows up in a resonance as a separate peak or, in the case of a very wide line, makes the quasi-uniform mode peak asymmetric. (10 refs.)

72679 Approximate theory of FMR and AR in weakly conducting ferromagnetic bulk metals. D.Fraitova (Inst. of Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.574-84 (1983).
The analytical expressions for the dispersion relations, the surface impedance, the line widths and the shifts of the resonance and antiresonance points are presented for the case of the ferromagnetic resonance (FMR) and the antiresonance (AR) in the parallel configuration and in the linear approximation of electrical conductivity. Further on, the amplitudes of the HF components of the magnetic field, of the magnetization, and the factors of ellipticity for three pairs of the waves propagating in the ferromagnetic bulk metal are derived in the FMR and AR regions. For the case of the FMR region the theory is valid only for the case of $\epsilon^2 \ll \Omega^2 L^2$, i.e. for materials with a low electrical conductivity, a small exchange stiffness constant, a large L.L. damping parameter at high frequencies, respectively. (16 refs.)

72680 Ferromagnetic resonance in holmium-yttrium iron garnets in the Ising model. R.Z.Levitin, A.I.Popov, V.V.Snegirev.
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1777-8 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3138-40 (Oct. 1982). [received: April 1983]
The authors show that the model of Ising-like ordering enables one to describe the features of the ferromagnetic resonance of holmium-yttrium iron garnets $Ho_xY_{3-x}Fe_5O_{12}$. (10 refs.)

Resistance of the amorphous magnetic alloy $Fe_{29}Ni_{49}P_{14}B_6Si_2$ as a function of temperature and stress ......See Entry 72372

Dependence of the magnetoresistance on dispersion properties of Permalloy films with allowance for the angular spatial dispersion of the anisotropy ......See Entry 72518

Boundaries of the long-wavelength part of the spin wave spectrum ......See Entry 72591

Impurity atom with an easy-plane anisotropy in a ferromagnet with an easy-axis anisotropy and ferromagnetic resonance ......See Entry 72599

Scanning electron microscope and ferromagnetic resonance investigations of fractured metglas 2826 alloy ......See Entry 73190

76.60 NUCLEAR MAGNETIC RESONANCE AND RELAXATION

72681 High-temperature investigations of NMR of ^{27}Al in dilute aluminium-zinc alloys. V.F.Kruglov, S.V.Verkhovskii, G.V.Kleshchev (Pedagogical Inst., Chelyabinsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.617-19 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An investigation was made of the integrated intensity of the NMR signal of ^{27}Al in alloys of aluminium containing 1.05 and 2.14 at.% Zn. The investigation was carried out at temperatures from the room value to 673K. The results were used to draw some conclusions on the thermal averaging of the electric field gradients and on the distribution of Al nuclei around Zn nuclei. (9 refs.) *A.T.*

72682 Parameters of Cu nuclear spin Hamiltonian in mixed crystals $(CH_3NH_3)_2Cu(Cl_{1-x}Br_x)_4$. H.Kubo (Dept. of Electronics, Kyushu Univ., Fukuoka, Japan), Y.Suzuki, M.Tanimoto, N.Uryu.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1373-81 (April 1983).
NMR measurements of Cu nuclei are carried out in the ferromagnetic region of these mixed crystals to clarify the dependences of the hyperfine field, H_{hf}, and the quadrupole frequency, ν_Q, on the surrounding ligand ions. Since the Cu^{2+} ground state is given by $d(x^2-y^2)$, the obtainedvalues of H_{hf} and ν_Q are due to the number, n, of BR$^-$ ions in the four ligands on the x- and y-axes and are fitted by the experimental formula, $H_{h}{}^{\mu}{}_{f}=H_{h}{}^{\mu}{}_{f}(0)+k_{h}{}^{\mu}{}_{f}n$ $(\mu{:}x,y,z)$ and $\nu_Q=\nu_Q(0)+k_Q n$, where k is the proportional constant. The differences between the hyperfine field along the x-axis and the y-axis are observed and are interpreted by the deviation from the tetragonal crystalline field. (17 refs.)

72683 Distribution of Cl$^-$ and Br$^-$ ions in mixed crystals $(CH_3NH_3)_2Cu(Cl_{1-x}Br_x)_4$. Y.Suzuki (Dept. of Electronics, Fukuoka Inst. of Technol., Fukuoka, Japan), H.Kubo.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1420-6 (April 1983).
NMR measurements of Cu and Cl nuclei are carried out at 1.75K to clarify the distribution of Cl$^-$ and Br$^-$ ions in the slowly grown mixed crystals $(CH_3NH_3)_2Cu(Cl_{1-x}Br_x)_4$ from an aqueous solution. The analysis of the Cu NMR spectra reveals that the Cl$^-$ and Br$^-$ ions do not distribute at random. By comparing the NMR intensities of Cl nuclei on the c-axis with those in the c-plane, it is concluded that most of Cl$^-$ ions preferentially occupy the positions in the c-plane.

72684 The ^{55}Mn and ^{57}Fe NMR study of FeCrMn alloys. H.Enokiya, M.Kawakami, R.Tanaka (Dept. of Phys., Kagoshima Univ., Kagoshima, Japan), T.Hihara.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1434-8 (April 1983).
The nuclear magnetic resonance (NMR) study has been made for the ^{55}Mn and ^{57}Fe nuclei in disordered ferromagnetic alloys $(Fe_{1-x}Cr_x)_{0.99}Mn_{0.01}$ $(x \leq 0.3)$ by the spin echo method in zero external magnetic field at 1.7K. The frequency corresponding to the centre of gravity of the ^{55}Mn NMR spectrum increases from 239.9 MHz at $x=0$ up to a maximum value of 267 ± 5 MHz at $x=0.20$ with increasing x and then decreases down to 236.4 MHz at $x=0.30$. The deduced value of the Mn magnetic moment increases monotonically from 0.72 μ_B at $x=0$ with increasing x, passes a maximum value of 1.33 μ_B at $x=0.20$ and then decreases to 1.2 μ_B at $x=0.3?$. This variation of the Mn moment with x is correlated with that of the Cr magnetic moment, and it is suggested that the moment of the Mn impurity is more localised in alloys with a higher Cr content. The ^{57}Fe NMR spectrum is also discussed.

72685 Multipole NMR. III. Multiplet spin theory. B.C.Sanctuary (Dept. of Chem., Univ. of York, Heslington, England).
Mol. Phys. (GB), vol.48, no.6, p.1155-76 (20 April 1983).
In selective multiquantum NMR specific transitions in the $(2I+1)$ manifold of levels are excited. In order to treat this problem the concept of multiplet spin I_M is introduced which takes all groups of closest $(2I_M+1)$ multiplets out of the $(2I+1)$ levels. The theory of multiplet spin is developed and related to the fictitious spin-$^1/_2$ formalism and the multipole approach. (26 refs.)

72686 NMR of ^{27}Al in paramagnetic single-crystal $DyAl_2$. Y.B.Barash, J.Barak (Soreq Nuclear Res. Centre, Yavne, Israel), A.Grayevsky.
Phys. Lett. A (Netherlands), vol.95A, no.5, p.252-4 (2 May 1983).
NMR of ^{27}Al was observed in a spherical single crystal of $DyAl_2$ in the paramagnetic state. The well split quadrupole spectrum yielded a quadrupole frequency $\nu_Q=561$ kHz and hyperfine constant $H_{hf}{}^{P}=-3.17$ kOe/n_B. The anisotropy on the spectrum is well explained by the dipolar interaction. (6 refs.)

72687 Nuclear magnetic resonance studies on sequence distributions in vinyl alcohol-vinyl acetate copolymers. S.Toppet (Dept. of Chem., Katholieke Univ. Leuven, Leuven, Belgium), P.J.Lemstra, G.Van der Velden.
Polymer (GB), vol.24, no.5, p.507-12 (May 1983).
The microstructure of vinyl alcohol-vinyl acetate copolymers was studied using both ^{13}C NMR and ^{1}H NMR techniques. The sequence lengths of vinyl acetate units calculated respectively from the compositional dyads, from the methylene absorptions and from the triple carbonyl absorptions in the ^{13}C NMR spectrum were not identical, and moreover the dyad-triad relationship showed a large discrepancy. ^{1}H and ^{13}C NMR spectra of a 5 mol.% reacetylated random sample, containing mainly isolated acetate units, indicate that configurational splitting complicates the assignment of the triple carbonyl absorption, which originally was interpreted as a compositional triad. After correcting for tacticities the results could be brought in line and the C=O resonances proved to be useful in obtaining information on the percentage of isolated vinyl acetate units and the sequence length $n_{2+}{}^{A}$ (the average length of vinyl acetate units ≥ 2). (30 refs.)

72688 Influence of rare earth subsystem on NMR gain in $ErFeO_3$. I.M.Vitebskii, A.S.Karnachev, E.E.Solov'ev (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1757-9 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3106-9 (Oct. 1982). [received: April 1983]
An experimental and theoretical study is made of the temperature dependence of the NMR gain in erbium orthoferrite at temperatures in the spin-reorientation region for different orientations of the exciting field with respect to the crystallographic axes. (4 refs.)

72689 Dynamic NMR frequency shift in the inverted state. V.I.Tsifrinovich (L.V. Kirenskii Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.399-400 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.715-17 (Aug. 1982). [received: May 1983]
The motion of the nuclear magnetization in the inverted state under the conditions of the dynamic NMR frequency shift is investigated. The conditions under which the NMR line has different shapes in the equilibrium and inverted states are found. It is shown that the line width changes considerably during the quasistationary transient process. (5 refs.)

Cross polarization magic-angle spinning NMR at cryogenic temperatures ......See Entry 70092

^{1}H NMR and ^{13}C NMR spectra of B-aminothiosulphonic derivatives related to pseudonorthioephedrine ......See Entry 70917

Study of a steric interaction effect in the benzofuran series ...See Entry 70918

Local order in amorphous polystyrenes: a high-resolution ^{13}C-NMR study ......See Entry 71908

Self and mutual diffusion measurements in dilute and semidilute polystyrene solutions ......See Entry 72147

Nuclear magnetic resonance and relaxation in itinerant electron ferromagnet Ni_3Al ......See Entry 72692

Application of optical polarization of nuclear moments and of NMR to the study of the physical properties of doped semiconducting materials ......See Entry 72701

Dynamic polarization and NMR of nuclei in the immediate vicinity of paramagnetic impurity centers ......See Entry 72712

Certain potentialities of double γ-nuclear magnetic resonance ......See Entry 72723

Detection of the incommensurate modulation of the hydrogen-bond double-minimum potential in the antiferroelectric phase of NH_4HSeO_4 ......See Entry 72740

76.60C Chemical and Knight shifts

72690 ^{13}C NMR chemical shift tensors of metal carbonyls. J.W.Gleeson, R.W.Vaughan (Div. of Chem. & Chemical Engng., California Inst. of Technol., Pasadena, CA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5384-92 (1 May 1983).
The principal components of the ^{13}C NMR chemical shift tensors of metal carbonyls containing between one and six metal atoms were determined from their powder patterns. The tensors of terminally bound CO groups are highly anisotropic (380±60 ppm) and nearly axially symmetric. The tensors of bridging CO groups are much less anisotropic, due to significant asymmetry in the electron orbitals about the C-O internuclear axis. The tensors vary only slightly for different transition metals. There is no intramolecular rearrangement of the metal carbonyls in the solid state at frequencies greater than 10 kHz, except in $Fe_3(CO)_{12}$. (58 refs.)

72691 Simulation of quadrupole disturbed NMR field spectra by using the exact solution of the Hamiltonian: application to zinc. J.Abart, E.Palangie, W.Socher, J.Voitlander (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany).
J. Chem. Phys. (USA), vol.78, no.9, p.5468-73 (1 May 1983).
The NMR signals of ^{67}Zn in polycrystalline zinc metal have been observed at frequencies between 8.8 and 13 MHz. Because of the large quadrupole interaction, the spectra have been recorded by sweeping the magnetic field. In order to evaluate the spectra with high accuracy, the authors have developed a variational method which is based on the exact solution of the NMR-Hamiltonian, for calculating the transition fields, the appropriate transition intensities and from those field spectra. From the comparison between the simulated and the experimental spectra of Zn, the authors evaluated a quadrupole coupling constant e^2qQ/h of 12.73 (4) MHz, an isotropic Knight shift K_{iso} of 0.15 (3)% and an axial one K_{ax} of 0.03 (3)%. The results are discussed in comparison with already known data. (22 refs.)

Nuclear magnetic resonance and relaxation in itinerant electron ferromagnet Ni_3Al ....See Entry 72692

76.60E Relaxation effects

72692 Nuclear magnetic resonance and relaxation in itinerant electron ferromagnet Ni_3Al. T.Umemura, Y.Masuda (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1439-45 (April 1983).
The nuclear magnetic relaxation rate of ^{27}Al in an itinerant electron ferromagnet Ni_3Al has been measured. The measurements were performed in the external fields from 1.0 to 50.0 kOe in both ordered and paramagnetic states. The temperature dependence of the Knight shift and susceptibility gives the hyperfine field arising from the Ni 3d-spin of $H_{hf}^{Al}(d)=-7.60$ kOe per Bohr magneton per Ni atom. The experimental results of the external field dependence of $(T_1T)^{-1}$ were reasonably well explained by using the self-consistent renormalisation (SCR) theory which takes account of the effect of spin fluctuations. (12 refs.)

72693 NMR study of solid perfluorocyclobutane. E.Szczesniak, J.R.Brookeman (Dept. of Phys., Univ. of Florida, Gainesville, FL, USA).
Mol. Phys. (GB), vol.48, no.6, p.1221-8 (20 April 1983).
Spin-lattice relaxation times and linewidth measurements for fluorine nuclei in solid perfluorocyclobutane are presented. The results are discussed in terms of D_{2d} molecular species performing fast internal motion. The relaxation measurements corroborate the existence of four solid-solid phase transitions and give some insight into their nature. The activation energies for molecular reorientation and self-diffusion processes are found to be 28.0 and 32.2 kJ mol.$^{-1}$, respectively. (20 refs.)

72694 Molecular reorientations of 1-bromo- and 1-iodo-adamantanes—^1H NMR relaxation study. J.Virlet, L.Quiroga, B.Boucher (Dept. de Phys.-Chimie, CENS, Gif-sur-Yvette, France), J.P.Amoureux, M.Castelain.
Mol. Phys. (GB), vol.48, no.6, p.1289-303 (20 April 1983).
Second moments and spin-lattice relaxation times, T_1 and $T_{1\rho}$, have been measured from 100K to 400K for the protons in powdered 1-bromo and 1-iodo-adamantanes. Analysis of these data have shown that the reorientations are uniaxial in the low temperature phases. In the high temperature disordered phase of bromo-adamantane, the reorientation is endospherical and a slow molecular translational motion also exists. In the high temperature disordered phase of iodo-adamantane the reorientation is 12-fold uniaxial, in agreement with the incoherent quasi-elastic neutron scattering (IQNS) experiments. All the results correspond to the crystallographic structures deduced from X-ray scattering. (20 refs.)

72695 T_1 as a function of Larmor frequency in solid CH_4 at 4.2K: an experiment on recent theories. E.Agostinelli, P.Calvani (Dipartimento di Fisica, Univ. di Roma I, Rome, Italy).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.118-20 (18 April 1983).
The spin-lattice relaxation time T_1 has been measured in partially converted samples at NMR frequencies ranging from 5 to 55 MHz. Results allow to check in detail the existing models for relaxation in solid CH_4. (10 refs.)

Spin-lattice relaxation theory of excited triplet-state impurities in molecular crystals ....See Entry 72313

Resolution of the conductivity dilemma in liquid solutions of alkali metals in alkali halides ....See Entry 72395

NQR study of the molecular motions of the ClO_3^- ion in chlorates ....See Entry 72696

76.60G Quadrupole resonance

72696 NQR study of the molecular motions of the ClO_3^- ion in chlorates. J.Kasprzak, J.Pietrzak (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.461-8 (April 1983).
^{35}Cl NQR frequency and spin-lattice relaxation time measurements for polycrystalline samples of sodium, barium and silver chlorates are reported. The following motional processes have been identified to be responsible for the electric field gradient (EFG) averaging and spin-lattice relaxation: anharmonic torsional motions in the low temperature range, hindered rotation of the ClO_3^- ion in the high temperature range and diffusion of water molecules in the case of barium chlorate. From data analysis, the activation energies for the above types of motions are determined. In silver chlorate a phase transition was observed at 415K. (18 refs.)

76.60L Spin echoes

72697 NMR spin echoes and quadrupole effects in nickel single crystals. J.Bunke, H.Bromer (Inst. a fur Phys., Abteilung fur Angewandte Kern- & Neutronenphys., Techn. Univ. Carolo-Wilhelmina, Braunschweig, Germany).
Hyperfine Interactions (Netherlands), vol.14, no.1, p.89-95 (April 1983).
NMR spin echo measurements of naturally abundant ^{61}Ni have been performed with Neel-type nickel single crystals at 4.2K. The NMR excitation condition could properly be chosen in order to get signals either from nuclei situated within magnetic domains or within domain walls. In both cases a quadrupole splitting of the NMR line could be observed. By applying an external magnetic field, the direction of the domain magnetization could be varied with respect to the FCC crystal lattice. From the variation of the quadrupole splitting with the crystallographic direction, the tensor of the electric field gradient (EFG) has been derived. The quadrupole splittings and the corresponding field gradients in the principal axis system of the EFG are: $\Delta\nu_{Q\langle 111\rangle}=13\pm1$ kHz, $\Delta\nu_{Q\langle 1\bar{1}0\rangle}=9\pm1$ kHz, $\Delta\nu_{Q\langle 11\bar{2}\rangle}=4\pm1$ kHz, $V_{\langle 111\rangle}=(6.6\pm0.5)\times10^{18}$ V/m^2, $V_{\langle 1\bar{1}0\rangle}=(4.6\pm0.5)\times10^{18}$ V/m^2, $V_{\langle 11\bar{2}(}=(2.0\pm0.5)\times10^{18}$V/m^2. (11 refs.)

76.70 MAGNETIC DOUBLE RESONANCES AND CROSS EFFECTS

72698 Spin effects in p^+-i-n^+ a-Si:H cells; photovoltaic detected magnetic resonance (PDMR). K.P.Homewood, B.C.Cavenett (Dept. of Phys., Univ. of Hull, Hull, England), W.E.Spear, P.G.LeComber.
J. Phys. C (GB), vol.16, no.13, p.L427-31 (10 May 1983).
This paper reports spin-dependent photovoltaic effects in p^+-i-n^+ a-Si:H cells. The preliminary results are important for two reasons. Firstly, the method of photovoltaic detected magnetic resonance (PDMR) complements the well known optically detected magnetic resonance (ODMR) technique as a means for investigating recombination processes in these devices, particularly since it is sensitive to all radiative and non-radiative processes. Secondly, the remarkable sensitivity of PDMR even up to room temperature suggests that the method is suitable for routine assessment of both amorphous and crystalline photovoltaic junctions and barrier devices. (14 refs.)

76.70E Dynamical nuclear polarization

72699 Electron-nuclear interactions in semiconductors during optical pumping. N.T.Bagraev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.36-42 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.455-62 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Conditions for optical polarization of nuclei in semiconductors during the hyperfine interaction with electrons trapped by impurity centers are examined. Optical polarization of nuclei in silicon doped with different impurities is investigated. Optimum conditions for producing the maximum polarization of lattice nuclei are determined. (16 refs.)

72700 Optical polarization of nuclear angular momenta in amorphous Si-Dy. N.T.Bagraev, L.S.Vlasenko, M.M.Mezdrogina (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.43-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.463-5 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Optical polarization of nuclei in the amorphous semiconducting alloy Si-Dy has been demonstrated. It is interpreted as being due to magnetic-ordering processes which result in the formation of ferrons, i.e. regions with local magnetic order. Nuclear polarization is found to be due to hyperfine interactions with three ferrons and with ferrons localized on broken bonds in the amorphous semiconducting alloy. (6 refs.)

72701 Application of optical polarization of nuclear moments and of NMR to the study of the physical properties of doped semiconducting materials. N.T.Bagraev, L.S.Vlasenko (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.46-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.466-8 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Optical polarization of lattice nuclei in crystals is used to investigate the decay of solid solutions of gold in dislocation-free silicon and in silicon containing different dislocation densities in the range 10^2-10^5 cm^{-2}. (6 refs.)

72702 Excited triplet states and optical polarization of nuclear magnetic moments in semiconductors. L.S.Vlasenko (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.49-54 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.469-75 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Optical polarization of nuclei was investigated in silicon containing crystal defects such as radiation defects, thermal defects, and dislocations. (no refs.)

72703 Optical polarization of nuclei and ESR in irradiation silicon. N.T.Bagraev, L.S.Vlasenko, V.M.Rozhkov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.55-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.476-9 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
A study is reported of optical polarization of lattice nuclei in silicon bombarded with electrons. It was found that the change in the size of the ESR signals due to Si-Si centers, which is observed in irradiated silicon under illumination, is correlated with a change in the optical polarization of ^{29}Si during the annealing of radiation defects. (3 refs.)

72704 Optical polarization of nuclei in the presence of deep impurity levels. L.L.Buishvili, N.P.Giorgadze, A.I.Tugushi (Tbilisi State Univ., Tbilisi, Georgian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.58-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.480-1 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
An analysis is given of possible mechanisms for the dynamic polarization of nuclei as a result of interaction with optically aligned electron spins of deep impurity centers. (6 refs.)

72705 Optical alignment of the bound electron-nuclear spin system of a semiconductor. R.I.Dzhioev, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.65-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.487-91 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
The optical alignment of the spins in a semiconductor can be accompanied by the appearance of internal feedback in the electron-nuclear spin system (ENSS). The importance of this effect increases with increasing time T_S during which the spin alignment of the electrons persists, and with increasing value of the ratio H_N/H of the effective field due to the nuclei to the external field. Under these conditions, the degree of circular polarization of the luminescence emitted by the semiconductor is a complicated function of small changes in the external magnetic field. Experimental results of this effect are presented, and it is concluded that optical alignment of electrons and nuclei in the presence of a strong interaction between them leads to new optical and magnetic phenomena which can be observed in weak magnetic fields, which is unusual in magnetooptics of semiconductors. (9 refs.)

72706 Optical cooling of the nuclear spin system of a semiconductor in conjunction with adiabatic demagnetization. V.K.Kalevich, V.D.Kul'kov, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.70-2 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.492-4 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
An analysis is given of the cooling of the nuclear spin system of a semiconductor which includes optical cooling by σ-light in a longitudinal magnetic field, followed by adiabatic demagnetization. (4 refs.)

72707 Effect of the field due to optically aligned electrons in a semiconductor on the polarization of nuclei in an inclined magnetic field. B.P.Zakharchenya, V.K.Kalevich, V.D.Kul'kov, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.73-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.495-7 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Optical alignment of conduction electrons in GaAs type semiconductors is accompanied by the polarization of the crystal nuclei as a result of the hyperfine interaction. In its turn, the effective magnetic field H_N due to the polarized nuclei acts on the average spin $\langle S\rangle$ of the aligned electrons. In practice, the degree of alignment of the electrons is determined by measuring the circular polarization $\rho = \langle S\rangle$ of the emitted luminescence. The presence of the nuclear field gives rise to a complicated dependence of ρ on the magnetic field. In a strong inclined magnetic field H, the effect of the nuclear field H_N gives rise to the appearance of an additional maximum on the ρ(H) curve for fields close to $H = H_N$. The direction of the field H_N depends on the sign of the g-factor of the conduction electrons. The authors show experimentally and theoretically that, in an inclined field, the $\rho(H)$ curve exhibits not only the above additional maximum but also a further maximum (which appears in a relatively weak field) which is connected with the compensation of the electron field H_e by the longitudinal component of the external field. (6 refs.)

72708 Resonance cooling of the nuclear spin system of a semiconductor with optically aligned electrons: experimental part. V.K.Kalevich, V.D.Kul'kov, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.498-501 to 76-9 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Optical cooling of the nuclear spin-system of a semiconductor when the conduction electrons are pumped by modulated circularly-polarized radiation in a perpendicular magnetic field whose strength is close to the resonance field for the lattice isotope, leads to the appearance of an effective magnetic nuclear field that is collinear with the external field. The direction of the nuclear field due to the individual isotopes corresponds to the negative sign of the g-factor g^* of the conduction electrons in GaAs, and to the positive sign in $Ga_{0.5}In_{0.5}P$. (7 refs.)

72709 Resonance cooling of the nuclear spin system in a semiconductor with optically aligned electrons: theoretical part. I.A.Merkulov, M.N.Tkachuk (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.80-2 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.502-4 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
A theoretical analysis is given of the cooling of the nuclear spin system in the lattice of a semiconductor, due to the hyperfine interaction with polarized electrons. Equations are derived for the temperatures of the Zeeman and the dipole-dipole reservoir. They constitute a generalization of the Provotorov equations dipole reservoir. They constitute a generalization of the Provotorov equations to the case where there is an interaction between the nuclei and the polarized electrons. (3 refs.)

72710 Experimental setup for enhanced ^{13}C NMR spectroscopy in solids using dynamic nuclear polarization. R.A.Wind, F.E.Anthonio, M.J.Duijvestijn, J.Smidt, J.Trommel, G.M.C.De Vette (Dept. of Appl. Phys., Delft Univ. of Technol., Delft, Netherlands).
J. Magn. Resonance (USA), vol.52, no.3, p.424-34 (May 1983).
If a solid contains free electrons the dynamic nuclear polarization (DNP) technique can be applied to enhance the ^{13}C signal by one or two orders of magnitude. The method demands irradiation near the electron Larmor frequency. The microwave part of the experimental setup is described as well as two probes in which DNP can be combined with ^{13}C FID or ^{13}C-^1H cross polarization experiments. In one of the probes magic-angle spinning can also be performed. The magnetic field strength used is 1.4T. Measurements are shown of enhanced ^{13} FID and CP spectra of a low volatile bituminous coal and of polystyrene doped with a stable radical. (19 refs.)

72711 Resonant cooling of the spin system of a superconductor lattice nuclei following optical orientation of the electrons [for superconductor read semiconductor]. I.A.Merkulov, M.N.Tkachuk (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.342-6 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.62-7 (Aug. 1982). [received: May 1983]
Cooling of the spin system of lattice nuclei as a result of hyperfine interaction with polarized electrons is considered when the mean electron spin (S) and the external alternating magnetic field (H_1) oscillate at a frequency close to that of the nuclear magnetic resonance. The equations obtained for the Zeeman and dipole-dipole reservoir temperatures are an extension of the Provotorov equations to the case of interaction between nuclei and polarized electrons. Solutions of the equations are presented for strong and weak magnetic fields. It is shown that the degree of cooling of the nuclear spin system has a resonant dependence on the modulation frequency of S and of H_1. In the case of an extremely weak alternating field the dependence is determined by the correlators of the total spin of the lattice nuclei. The solution for a saturating field H_1 does not depend on the form of the spin correlators. (8 refs.)

72712 Dynamic polarization and NMR of nuclei in the immediate vicinity of paramagnetic impurity centers. M.D.Zviadadze, B.D.Mikaberidze (Phys. Inst., Acad. of Sci., Georgian SSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.441-7 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.787-98 (Aug. 1982). [received: May 1983]
The authors investigate the dynamic polarization mechanisms and calculate the polarization amplification factors and the absorption signals of the NMR 04 nuclei in the immediate vicinity of paramagnetic impurity centers in solid dielectrics under conditions of pulsed and steady saturation of allowed and forbidden EPR transitions of the impurity, with account taken of the electron dipole reservoir. In contrast to the impurity nuclei proper and the remote nuclei of the host lattice, the nearby nuclei are polarized even under pulsed saturation of allowed transitions. It is known that the preliminary polarization of the nearby nuclei by microwave pumping can increase the sensitivity of NMR-signal measurements by two or three orders of magnitude. (24 refs.)

Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids ....See Entry 69773

76.70F Double nuclear magnetic resonance (DNMR)

Experimental setup for enhanced ^{13}C NMR spectroscopy in solids using dynamic nuclear polarization ....See Entry 72710

76.70H Optical double magnetic resonance (ODMR)

72713 New possibility for EPR studies by laser polarimetry. E.B.Aleksandrov, V.S.Zapasskii.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.6-10 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.423-8 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
The authors investigate the possibilities of optical EPR methods that rely on the use of laser sources. Magnetic resonance spectra are recorded in the noise spectra of the Faraday rotation of a laser beam induced by various paramagnetic crystals. It is found that, without complicating the optical EPR detection, magnetization noise turns out to be of interest in itself and provides a completely new approach to the study of paramagnetism. The spectrum of the magnetization fluctuations contains the same information as the EPR spectrum, but, in contrast to the EPR spectrum which is proportional to the magnetic polarization of the medium and for which the resonance must be induced by a variable magnetic field, the magnetization is found to fluctuate even when the average macroscopic magnetization is zero or even when the variable external field is zero. This presents one with a unique possibility of being able to investigate the relaxation times as functions of the field H and temperature T without imposing the restrictions on these two variables that are necessary in conventional EPR techniques in which the signal strength depends on the ratio H/T. (12 refs.)

72714 Optical detection of EPR using the luminescence emitted by crystal defects. P.G.Baranov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.15-21 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.433-9 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Recent work using optical detection of EPR in crystal defects is reviewed. The review covers papers in which recombinational tunnelling afterglow has been used to detect EPR in electron and hole centers in crystals, and summarizes the results of studies of the spatial distribution of wave functions of unpaired electrons in doublet and triplet relaxed excited states. (18 refs.)

72715 Giant spin splitting of exciton states and optically detected magnetic resonance in A^2B^6 crystals containing magnetic impurities. S.M.Ryabchenko (Phys. Inst., Acad. of Sci., Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.22-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.440-5 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
A review is given of recent work on giant spin splitting of exciton states in magnetically mixed semiconductors of the form $A^2{}_xMe_xB^6(A^2B^6{:}Me$, where Me-3d metal), which appears as a result of the exchange interactions between carriers and localized magnetic moments during spin polarization of the latter by an external magnetic field. A model of the phenomenon is described and its various manifestations in magnetooptics are discussed. (24 refs.)

Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids ....See Entry 69773

76.80 MÖSSBAUER EFFECT; OTHER GAMMA-RAY SPECTROSCOPY

72716 Influence of the distribution of carbon atoms on the quadrupole interaction in Fe-Ni-C austenite. V.G.Gavrilyuk, V.M.Nadutov (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.520-7 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An analysis was made of the various configurations of iron and carbon atoms at the nearest interstices in the f.c.c. lattice on the magnitude and sign of the electric field gradient (EFG) and, consequently, on the quadrupole interaction of the iron atoms. In the case of iron atoms with one or two carbons at the nearest octahedral interstices the EFGs were identical in magnitude and opposite in sign. In the case of the dumbbell configuration the EFGs were twice as high. The results of a Mossbauer effect study indicated the existence, in the investigated austenite, of a pair of carbon atoms at interstices next to resonating iron nuclei. (19 refs.) *A.T.*

72717 Investigation of technical-grade beryllium by the Mossbauer effect method. Yu.P.Khimich, G.N.Belozerskii, V.N.Gittsovich, S.V.Lyubarskii, S.B.Tomilov, G.V.Bel'chenko (A.A. Zhdanov State Univ., Leningrad, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.610-12 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the redistribution of carbon atoms, and of the formation and dissolution of excess phases containing iron as a result of heat treatments applied to hot-pressed beryllium prepared by the ceramic method. The annealing temperature (450-1000°C) affected not only the relative intensities of the components of the Mossbauer spectra but also other parameters. The results obtained of a study of the rolling texture indicated that the Mossbauer effect in ^{57}Fe nuclei provided an effective method for investigating the structure and phase of beryllium. (10 refs.) *A.T.*

72718 Measurements of the hyperfine magnetic fields at Ta and Fe in the Laves compound $(Zr_xHf_{1-x})Fe_2$ for $0 \leq x \leq 1$. Z.Z.Akselrod, M.Budzynski, T.Khazratov, B.A.Komissarova, L.N.Kryukova, S.I.Reiman, G.K.Ryasny, A.A.Sorokin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Hyperfine Interactions (Netherlands), vol.14, no.1, p.7-19 (April 1983).
The hyperfine magnetic fields at ^{181}Ta and ^{57}Fe in the ferromagnetic Laves intermetallic compounds $(Zr_xHf_{1-x})Fe_2$ $(0 \leq x \leq 1)$ have been measured by the methods of TDPAC and Mossbauer effect, respectively, and shown to be practically independent of x at $x \geq 0.4$. An average value $B_{hf}(Ta) = -6.52$ T at 300K was obtained for samples with $x \geq 0.4$, and -14.2 T for pure $HfFe_2$ in the hexagonal C14 modification. For $0 < x < 0.4$, a superposition of both field components was observed. A deviation of the temperature dependences of $B_{hf}(Ta)$ in $(Zr_{0.9}Hf_{0.1})Fe_2$ from that for $B_{hf}(Fe)$ and the bulk magnetization was confirmed, studied in detail, and shown to exist for all $x \geq 0.4$. The temperature dependence of $B_{hf}(Ta)$ in $HfFe_2$ was close to that of $B_{hf}(Fe)$. (18 refs.)

72719 Analytical solution for the ^{57}Fe Mossbauer spectra for octahedral cage hopping and correlated electric field gradient fluctuations. F.J.Litterst, V.D.Gorobchenko, G.M.Kalvius (Phys. Dept. Techn. Univ. Munchen, Munchen, Germany).
Hyperfine Interactions (Netherlands), vol.14, no.1, p.21-35 (April 1983).
The authors derive an analytical solution for the Mossbauer relaxation spectra of ^{57}Fe in the case of correlated jump diffusion and electric field gradient rotation in an octahedral cage. (16 refs.)

72720 Mossbauer spectroscopy of laser annealed tellurium implanted silicon. I. ^{119}Sn and ^{125}Te. G.J.Kemerink, H.de Waard, L.Niesen, D.O.Boerma (Lab. voor Algemene Natuurkunde, Rijksuniv., Groningen, Netherlands).
Hyperfine Interactions (Netherlands), vol.14, no.1, p.37-51 (April 1983).
Laser annealed Te-implanted silicon has been investigated using ^{119}Sn and ^{125}Te Mossbauer spectroscopy. The ^{119}Sn Mossbauer spectra consist of a single lorentzian, known to be due to substitutional Sn atoms in Si, independent of the type of doping of the silicon. The results on ^{125}Te reveal at least two different components. In heavily doped n-type Si a single line component is observed with an isomer shift of 0.15(5) mm/s with respect to SnTe and an effective Debye temperature of 207(3)K. Heavy p-doping leads to another single line component with an isomer shift of $-0.13(5)$ mm/s and an effective Debye temperature of 232(3)K. These components are ascribed to the neutral and doubly positive charge state of substitutional Te atoms, respectively. (50 refs.)

72721 Mossbauer spectroscopy of laser annealed tellurium implanted silicon. II. ^{129}I. G.J.Kemerink, H.de Waard, L.Niesen, D.O.Boerma (Lab. voor Algemene Natuurkunde, Rijksuniv., Groningen, Netherlandsl).
Hyperfine Interactions (Netherlands), vol.14, no.1, p.53-88 (April 1983).
For pt.I see ibid., vol.14, p.37 (1983). Laser annealed ^{129m}Te-implanted silicon has been investigated using ^{129}I Mossbauer spectroscopy. At least three dope-dependent charge states of substantial iodine are found. For heavily doped p-type Si a single line component S_1, with isomer shift $S = 0.96(4)$ mm/s w.r.t. $Cu^{129}I$ and an effective Debye temperature $\theta' = 196(3)$K is observed. This component is attributed to I^{++}. For compensated Si a single line component, S_2, assigned to I^+, with $S = 2.39(4)$ mm/s and $\theta' = 170(3)$K is found. For n-type Si, a component S_3, characterized at 4.2K by $S = 2.15(4)$ mm/s and a quadrupole splitting $eQV_{zz}/h = 452(8)$ MHz $(\eta \simeq 0)$ is observed. At higher temperatures S_3 shows quadrupole relaxation and its recoilless fraction becomes strongly anisotropic. This behaviour is explained on the basis of a transition from a static to a dynamic Jahn-Teller distortion. Component S_3 has been attributed to I^0. In the spectra of compensated and n-type Si a less well-defined component Q, with parameters resembling those of S_3 but showing no quadrupole relaxation, is observed. This component has tentatively also been assigned to I^0. The results can be understood qualitatively on the basis of a simple MO-model. (30 refs.)

72722 On the Mossbauer isomer-shift studies of the electronic structure of semiconductors. E.Antoncik, Bing-lin Gu (Inst. of Phys., Univ. of Aarhus, Aarhus, Denmark).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.69-71 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The Mossbauer isomer shift provides a unique technique for studying the electronic structure of solids on the atomic scale and in many cases makes it possible to check the accuracy of the wave functions resulting from either the band-structure calculations or the solution of the impurity problem. Using a Green-function procedure based on a modified tight-binding method, the electronic configuration and the relevant isomer-shift values have been evaluated for several physically interesting cases. In particular, ^{119}Sn, ^{121}Sb, and ^{125}Te, representing either one of the components or an impurity in various A^NB^{8-N} semiconducting materials, are considered, and their local structure is discussed in detail. (9 refs.)

72723 Certain potentialities of double γ-nuclear magnetic resonance. T.Sh.Abesadze, A.Ya.Dzyublik.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.563-7 (April 1983). In Russian.
A theory is developed for the Mossbauer γ-quanta absorption and scattering by polarized ^{57}Fe nuclei in a crystal when the NMR transitions between sublevels of the ground nuclear state are induced. It is shown that this double γ-nuclear magnetic resonance can give information on the spin-spin interactions of the nuclei. (14 refs.)

A Mossbauer study of the variation in Neel temperature in iron-rare earth layer compounds .... See Entry 72604

Spin glass behavior of some rapidly quenched iron (2+) aluminosilicates .... See Entry 72612

Competing ferromagnetic and spin-glass order in a *Au*Fe alloy .... See Entry 72615

Magnetic properties of $REFe_2Si_2$ compounds .... See Entry 72636

Magnetic and electronic properties of thin iron oxide films .... See Entry 72644

An ESCA and Mossbauer study of the oxide layer formed on steel in water containing chromate and chloride ions .... See Entry 73256

Mossbauer absorption in overdamped harmonically bound particles in Brownian motion .... See Entry 73507

76.90 OTHER TOPICS IN MAGNETIC RESONANCES AND RELAXATION

(inc. muon probe studies)

72724 Muon spin rotation in antiferromagnetic oxides. C.Boekema (Los Alamos Nat. Lab., Los Alamos, NM, USA), A.B.Denison, K.J.Ruegg.
J. Magn. & Magn. Mater. (Netherlands), vol.36, no.1-2, p.111-14 (April 1983).
Muon spin rotation results for antiferromagntic oxides with the corundum structure are discussed. An attempt to determine the muon stop sites and their chemical environment in these oxides is presented. In addition to the magnetic dipole contribution, a covalent contribution to the effective magnetic field at the muon site is considered. An interpretation of the muon hyperfine interactions in these oxides in terms of muon bond formation, analogous to the hydrogen-oxygen bonding, is given. (15 refs.)

Structure of muons trapped in aluminium .... See Entry 72344

77.00 DIELECTRIC PROPERTIES AND MATERIALS

(for conductivity phenomena, see 72.20 and 72.80)

77.20 PERMITTIVITY

72725 Contribution to the study of mixtures susceptible to microemulsion formation on account of their compositions by the definition of their dielectric permittivity at 9.455 GHz. J.M.Moreau, G.Delbos, A.M.Botteau (Lab. de Spectronomie Temporelle et Frequentielle, Univ. de Bordeaux I, Talence, France).
J. Mol. Liq. (Netherlands), vol.25, no.2, p.91-101 (April 1983). In French.
Dielectric studies of four component mixtures are rarely made on a great number of concentrations. The authors propose a dielectric behavior study of mixtures made with toluene-water-butanol-SDS, from specific mappings of permittivities which are plotted on pseudo ternary diagrams at 9.455 GHz. They draw different conclusions as to how at 9.455 GHz the variations of real and imaginary parts of permittivity involve the concentration of each component and the structure of the mixture. (49 refs.)

72726 Glass formation and properties of chalcogenide systems. XXVI. Permittivity and the structure of glasses As_xSe_{1-x} and Ge_xSe_{1-x}. A.Feltz, H.Aust, A.Blayer (Dept. of Chem., Friedrich Schiller Univ., Jena, Germany).
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.179-90 (May 1983).
Correlation between the real part of the dielectric constant and the structure of glasses in the systems As_xSe_{1-x} and Ge_xSe_{1-x} is reported. The mole polarization is calculated using the Sellmeyer approximation neglecting the Lorentz field. The vibrationally caused part of the permittivity which is obtained by subtraction of the mole refraction reflects ordered states in the investigated series. Besides the known crystalline compounds As_2Se_3 and As_4Se_4 the formation of the vitreous $AsSe_3$ and As_3Se_2 from the liquid state has to be supposed. In the system Ge_xSe_{1-x} the formation of the compounds $GeSe_2$ and Ge_2Se_3 is completed by $GeSe_4$ which as Ge_2Se_3 obviously only exists in the non-crystalline state. $GeTe_4$ has been reported as a metastable crystalline phase. The temperature dependence of ε_r of vitreous As_2Se_3 is tentatively interpreted in terms of the dipole orientation caused by conversion of the charge in valence alternation pairs. (51 refs.)

72727 On the dielectric Curie-Weiss law and diffuse phase transition in ferroelectrics. G.H.Jonker (Dept. of Electrical Engng., Twente Univ. of Technol., Enschede, Netherlands).
Mater. Res. Bull. (USA), vol.18, no.3, p.301-8 (March 1983).
A simple derivation of parabolic $1/\epsilon_r$-T curves is obtained by reconsidering the origin of the dielectric Curie-Weiss law. The only assumption needed is the introduction of a non-linear temperature dependence of the macroscopic dielectric polarization in the macroscopic Clausius-Mossotti equation. (12 refs.)

72728 The influence of microstructure on the dielectric spectra of ferrites. G.P.Kramar, Ya.I.Panova, V.V.Passynkov (V.I. Ulyanov (Lenin), Leningrad.Electrical Engng. Inst.,USSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.95-100 (16 March 1983).
Ceramic specimens of Mn-Zn ferrites of different compositions and microstructures are investigated in the frequency range from 100 Hz to 20 MHz and at temperatures from 20 to 130°C. Mathematical expressions (taking into account the actual distribution of grain sizes in the specimen) are proposed to describe the frequency dependence of the complex permittivity components. It is shown that the dielectric spectrum of polycrystalline ferrites reveals two relaxation processes. The process of grain surface state recharge gives the main contribution to the static permittivity and its parameters essentially depend on the firing temperature. The parameters of the high-frequency relaxation process due to the existence of low-conductivity layers of grain surfaces correlate with the parameters of the microstructure. (5 refs.)

Dielectric permittivity measurements in the ultralow frequency region .... See Entry 70085

Dielectric evidence for existence of two-level-systems in cyclohexanol, a 'glassy crystal' system .... See Entry 71913

Measurements of densities and dielectric constants of liquid propane from 90 to 300K at pressures to 35 MPa .... See Entry 72025

Effect of uniaxial compression on the ferroelastic phase transitions in layered $KSc(MoO_4)_2$ .... See Entry 72103

Intramolecular relaxation processes of some aromatic esters ...See Entry 72731

Infrared reflection spectra of gypsum .... See Entry 72809

Dielectric dispersion in optical electron transfer in solution .....See Entry 72944

Dependence of the dielectric properties, porosity, and apparent density of quartz ceramic on the phase of composition .... See Entry 73047

Dielectric studies of sonicated egg yolk lecithin at around 800 MHz .... See Entry 73529

77.30 POLARIZATION AND DEPOLARIZATION EFFECTS

72729 Phenomenological theory of shock-induced polarization. I. M.de Icaza-Herrera (Inst. de Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
J. Appl. Phys. (USA), vol.54, no.5, p.2352-9 (May 1983).
After reviewing the actual state of knowledge of Shock-Induced Polarization, the authors discuss the validity of Allison's theory, specially concerning the physical meaning of his three parameters P_s^0, K', and τ. They then propose another approach, splitting the electric field in the dielectric into two components: the electric field (uniform) produced by the charges in the plates, and the electric field (nonuniform) produced by the polarization charges. This enables one to relate the line integral of polarization across the dielectric with an easily measurable potential difference $F(t)$. Its time derivative $F(t)$ is then found to be related with the polarization discontinuity across the shock front, without making any assumptions on the space or time dependence of polarization. Later, the authors introduce the dielectric properties in a Lagrangian frame, which are finally inserted, in Eulerian form, in $F(t)$. Four equations for $F(t)$ are obtained, depending on the relaxing properties of the nonshocked medium and on the mechanism producing the polarization: the dipolar orientation or the bond scission model. The authors also present the $F(t)$ equation when there is no reflected shock at the second electrode, the entire dielectric being shocked. (26 refs.)

High-resolution probing of surface-charge distributions on corona-and friction-charged teflon FEP foils .... See Entry 70086

Thermally stimulated relaxation currents due to forces of nonelectrostatic origin .... See Entry 72424

On the dielectric Curie-Weiss law and diffuse phase transition in ferroelectrics .... See Entry 72727

Dielectric and pyroelectric properties of doped triglycine sulphate crystals [for infrared detectors] .... See Entry 72742

Brillouin scattering study of the anisotropic relaxation of the polarisation fluctuation in ferroelectric TGS .... See Entry 72818

77.40 DIELECTRIC LOSS AND RELAXATION

72730 An equation to calculate the equilibrium constant of 1:1 complexes from dielectric relaxation measurements. A.Singh, M.C.Saxena (Phys. Dept., Lucknow Univ., Lucknow, India).
J. Mol. Liq. (Netherlands), vol.25, no.2, p.81-90 (April 1983).
The dielectric measurements of 1:1 mixture of acetates, namely ethyl acetate, butyl acetate and benzyl acetate and phenol and n-butyl alcohol in carbon tetrachloride at 9.8 GHz microwave frequency were carried out. A method has been proposed to calculate the equilibrium constant of 1:1 hydrogen bonded complexes. These values are in close agreement to the values obtained using the Few and Smith method (1949). (18 refs.)

72731 Intramolecular relaxation processes of some aromatic esters. M.A.Kashem, H.A.Khwaja, S.Walker (Lakehead Univ., Thunder Bay, Ontario, Canada).
J. Mol. Liq. (Netherlands), vol.25, no.2, p.129-37 (April 1983).
Dielectric absorption measurements have been made in the frequency range 10^2-10^5 Hz over a variety of temperatures on dimethyl terephthalate, dimethyl 2,6-naphthalene dicarboxylate, methyl and ethyl benzoates, ethyl-p-chlorobenzoate, methyl and ethyl cinnamates, and methyl salicylate. The solutes have been dispersed in a polystyrene matrix and in four cases also in a polyphenyl ether medium. One compound, methyl salicylate, was also examined as a pure compressed solid. The Eyring parameters have been determined and employed to characterize the relaxation processes. The results are discussed in terms of molecular and intramolecular processes involving the whole ester grouping or the methoxy group or an overlap of both processes. In the case of methyl salicylate the barrier for the methoxy group relaxation has been determined in the compressed solid state. (28 refs.)

72732 On the dielectric properties of semiconducting materials as obtained from impedance measurements on Schottky barriers. F.Fransen (Rijksuniv. Gent, Gent, Belgium), M.J.Madou, W.H.Laflere, F.Cardon, W.P.Gomes.
J. Phys. D (GB), vol.16, no.5, p.879-88 (14 May 1983).
Dielectric properties of several semiconducting materials were studied by impedance measurements of metal/semiconductor and electrolyte/semiconductor Schottky barriers. Power laws of the frequency were observed analogous to those reported for insulating materials. Also the relationship between the tangent of the loss angle and the bandgap of the semiconductor appeared to be similar to that observed on insulators. The results indicate that the residual frequency dispersion of the Schottky-barrier capacitance, persisting after careful pretreatment of the semiconductor surface, can be ascribed to the dielectric properties of the space-charge layer. (16 refs.)

72733 Dielectric relaxation of adsorbed water in microcrystalline cellulose. M.Kent, W.Meyer (Ministry of Agriculture, Fisheries & Food, Torry Res. Station, Aberdeen, Scotland).
J. Phys. D (GB), vol.16, no.5, p.915-25 (14 May 1983).
Measurements have been made to determine the dielectric properties of hydrated microcrystalline cellulose (MCC) in a frequency range from 200 MHz to 18 GHz. A broad dispersion region has been observed, characterised by a Cole-Davidson relaxation. The activation enthalpy of the charateristic relaxation time has been determined from the temperature dependence of the dispersion and corresponds roughly to two hydrogen bonds. The dispersion is identified as being due to the absorbed water and is shown to be moisture content dependent. (15 refs.)

72734 Intramolecular relaxation processes of benzophenone and related molecules in glassy media. M.A.Desando, D.L.Gourlay, S.Walker (Dept. of Chem., Lakehead Univ., Thunder Bay, Ontario, Canada).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.559-70 (April 1983).
Radiofrequency (10^2-10^5 Hz), variable temperature (77-333K) dielectric loss measurements were performed for a series of diaryl ketones and pyridyl ethylenes in polystyrene, and in the case of benzophenone and 2,3,4,5,6-pentadeuterobenzophenone also in *o*-terphenyl and in Santovac {bis[*m*(*m*-phenoxy phenoxy)phenyl]ether}. An intramolecular process with a low enthalpy of activation ($\Delta H_E \approx 20$ kJ mol^{-1}) was observed in the benzophenones and $\Delta H_E \approx 30$ kJ mol^{-1} for bis(2-pyridyl) ketone and 1,2-bis(2- and 4-pyridyl) ethylene. A mesomeric process would seem to be the most probable intramolecular mechanism through which these symmetrically substituted ketone and ethylene derivatives relax. The observed relaxation processes seem to be unaffected by varying the medium. (31 refs.)

The influence of microstructure on the dielectric spectra of ferrites .... See Entry 72728

Dynamic critical behavior of ferroelectric triglycine sulfate from dielectric loss measurements .... See Entry 72741

Brillouin scattering study of the anisotropic relaxation of the polarisation fluctuation in ferroelectric TGS .... See Entry 72818

77.50 DIELECTRIC BREAKDOWN AND SPACE-CHARGE EFFECTS

72735 Electrical properties of post-annealed thin SiO_2 films. S.S.Cohen (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.929-32 (April 1983).
Very thin films of silicon dioxide grown in a conventional dry oxidation process often suffer from poor electrical quality due to the presence of various defects. A low dielectric breakdown is, in particular, detrimental to the operation of many electronic devices. The author has attempted to improve this situation by modifying the dry oxidation process. He shows that oxides grown in oxygen ambient and under atmospheric pressure, which are postannealed for a long period of time in an inert atmosphere and then reoxidized for a short time, have considerably improved values of both the magnitude and distribution of the electric field at the dielectric breakdown. Very few low-field dielectric breakdown events are encountered and the breakdown field histogram assumes a very narrow shape. (18 refs.)

72736 The role of electrostatic and hydrodynamic forces in the electrical breakdown of liquid dielectrics. P.K.Watson (Xerox Corp., Rochester, NY, USA).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.65-70
Optical studies of pre-breakdown events in point-plane gaps in insulating liquids enable one to distinguish at least three stages in the breakdown process: (i) The creation of a low density region adjacent to the point electrode. (ii) The growth of a wave-like disturbance in the surface of the low density region, which is interpreted as an electrohydrodynamic instability. (iii) The runaway growth of the instability leading to streamers which bridge the gap and cause the actual breakdown. This analysis is mainly concerned with the electrostatic aspects of these three stages in the breakdown process. (16 refs.)

High-power laser radiation damage to transparent insulators .. See Entry 72015

Experimental verification of the space-charge model for electrokinetics in charged microporous membranes .... See Entry 72172

Accumulation and discharging of the hole charge in oxide layers of MIS structures .... See Entry 72510

77.55 DIELECTRIC THIN FILMS

Electrical properties of post-annealed thin SiO_2 films ....See Entry 72735

77.60 PIEZOELECTRICITY AND ELECTROSTRICTION

(for piezo-optical effects, see 78.20H)

72737 Voltage dependence of the d_{31} tensor element in $Pb(Ti,Zr)O_3$. D.M.Tratt (Dept. of Phys., Heriot-Watt Univ., Edinburgh, Scotland).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.635-7 (May 1983).
Quasistatic measurements of the d_{31} piezoelectric strain coefficient are presented for PZT-5H material. Bulk data analysis techniques have been applied to assess the voltage-dependent contribution to the induced strain. (5 refs.)

Influence of thermal annealing on thermoelectric properties of normal and neutron-doped silicon crystals .... See Entry 72429

Kinetic theory of the displacement photovoltaic effect in piezoelectrics .... See Entry 72451

Dislocation theory for long-term memory in stimulated electroacoustic-echo effect in powdered piezoelectrics .... See Entry 72454

Phenomenological theory of shock-induced polarization. I ....See Entry 72729

77.70 PYROELECTRIC AND ELECTROCALORIC EFFECTS

72738 Temperature changes of the primary and secondary pyroelectric effect in $LiKSO_4$ crystal (100-300K). B.Mroz, T.Krajewski, T.Breczewski (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.445-8 (April 1983).
Anomalous changes of pyroelectric effect in $LiKSO_4$ crystals in the temperature region between 100 and 300K were analysed in detail. It was found that the change in sign of the total pyroelectric effect coefficient p_3^{σ} of $LiKSO_4$ crystals at about 190K is mainly caused by the change in sign of p_3^{π} coefficient, which defines the magnitude of the primary pyroelectric effect in this crystal. The temperature changes of p_3^{s} coefficient, defining the magnitude of the secondary pyroelectric effect in $LiKSO_4$ crystals, were found to be inessential in the phenomenon analysed. (12 refs.)

Dielectric and pyroelectric properties of doped triglycine sulphate crystals [for infrared detectors] .... See Entry 72742

77.80 FERROELECTRICITY AND ANTIFERROELECTRICITY

72739 SbSI and other ferroelectric $A^VB^{VI}C^{VII}$ materials. E.I.Gerzanich (Uzhgorod State Univ., Uzhgorod, USSR), V.A.Lyakhovitskaya, V.M.Fridkin, B.A.Popovkin.
In book: *Current topics in materials science. Vol.10*, E.Kaldis [Ed.], p.55-190. Amsterdam, Netherlands: North-Holland (1982), vi+515 pp. [0 444 86321 4]
The authors' survey indicates that by now the investigation of ferroelectric of $A^VB^{VI}C^{VII}$ type is of considerable fundamental and applied interest. The combination of ferroelectric, semiconducting and photoconducting properties of SbSI and related compounds allowed the first discovery of photoferroelectric phenomena. One of these phenomena is the effect of photoactive illumination and the corresponding creation of non-equilibrium carriers on the Curie temperature, spontaneous polarization and other macroscopic properties of ferroelectrics (photodomain effect, photoswitching etc.). (324 refs.)

Features of laser damage to ferroelectric crystals ....See Entry 72009

Optical activity and circular dichroism spectra of pure and deuterated Rochelle salt crystals ....See Entry 72762

On the nature of piezooptical coefficient temperature anomalies in triglycine sulphate group crystals ....See Entry 72768

Electro-optic effects of (Pb, La)(Zr, Ti)O_3 thin films prepared by RF planar magnetron sputtering ....See Entry 72770

Temperature dependence of the low frequency Raman scattering spectra in tetramethylammonium tetrachlorozincate ....See Entry 72794

Brillouin scattering study of the anisotropic relaxation of the polarisation fluctuation in ferroelectric TGS ....See Entry 72818

77.80B Transitions and Curie point

72740 Detection of the incommensurate modulation of the hydrogen-bond double-minimum potential in the antiferroelectric phase of NH_4HSeO_4. I.P.Aleksandrova, O.V.Rosanov, A.A.Sukhovsky, Yu.N.Moskvich (L.V. Kirensky Inst. of Phys., Krasnoyarsk, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.339-42 (9 May 1983).
An incommensurate antiferroelectric phase in the NH_4HSeO_4 crystal was found by ^{77}Se high-resolution NMR in the temperature range 250-262K. An anomalous line-shape continuum limited by two-edge singularities is observed in this region and described by plane-wave modulation. A model where the asymmetry of proton occupation in the H-bond system is modulated along a certain direction is discussed. The incommensurate structure is metastable. (15 refs.)

72741 Dynamic critical behavior of ferroelectric triglycine sulfate from dielectric loss measurements. R.Garcia, J.A.Gonzalo (Dept. de Optica y Estructura de la Materia, Univ. Autonoma de Madrid, Madrid, Spain).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1501-4 (9 May 1983).
Measurements of the dielectric loss in triglycine sulfate are shown to yield information on the critical temperature dependence of the relaxation time, $\tau(t)$, where $t \equiv (T-T_c)/T_c$. The data indicate a power law $\tau^{-1}(t) \sim t^x$, where $x = 0.656 \pm 0.025 \simeq {}^2/_3$ for $7 \times 10^{-2} < \Delta T < 1.5°C$ at $T > T_c$. $\tau(t)$ does not diverge at T_c, in accordance with theoretical considerations. For $T < T_c$ the data suggest a similar behavior. The role of logarithmic corrections is analyzed, and estimates of the correlation length amplitude $\xi_0 \simeq 7.86$ Å and the dipole-dipole constant $g \simeq 3.44 \times 10^{-7}$ Å^{-2} are obtained. (16 refs.)

On the dielectric Curie-Weiss law and diffuse phase transition in ferroelectrics ....See Entry 72727

Optical properties of K_2SeO_4 in the vicinity of phase transitions ....See Entry 72753

Analysis of the soft mode behaviour in $Li_2Ge_7O_{15}$ in terms of a coupled-mode model ....See Entry 72789

77.80D Domain structure and effects; hysteresis

72742 Dielectric and pyroelectric properties of doped triglycine sulphate crystals [for infrared detectors]. A.K.Batra, S.C.Mathur, D.C.Dube (Dept. of Phys., Indian Inst. of Technol., Delhi, New Delhi, India), A.Mansingh.
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.243-4 (May 1983).
The authors studied the dielectric (spontaneous polarisation, coercive field and self-bias field) and pyroelectric properties of Ni, Cu and Fe/L-alanine doped TG-S ferroelectric crystals. Using these properties, applicable figures of merit are calculated for comparison. (6 refs.)

78.00 OPTICAL PROPERTIES AND CONDENSED MATTER SPECTROSCOPY AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

(for phonon spectra, see 63.)

78.20 OPTICAL PROPERTIES AND MATERIALS

(see also 81.40T Optical properties related to materials treatment; for masers, and lasers see 42.52 and 42.55 respectively)

72743 Multiphoton processes in light absorption by homopolar crystals. Self-trapping and classical solutions [for multiphoton read multiphonon]. A.S.Ioselevich (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.415-21 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.743-55 (Aug. 1982). [received: May 1983]
The absorption of light with a photon energy deficit $\Delta = E_g \rightarrow \hbar\Omega \gg \hbar\omega_{,0}$, with participation of a large number of optical strain phonons at frequency ω_0, is considered. It is shown that at low temperatures $T < \hbar\omega_0$ two alternate mechanisms exist. The first is connected with absorption of the required number of phonons from the thermostat, and the second with tunnel self-trapping. The Δ-dependent temperature limit $T^* < \hbar\omega_0$ above and below which the first and second process dominate, respectively, is found. The existence of several absorption mechanisms manifests itself in the fact that the classical solution that describes a multiphonon transition of an electron-phonon systems is not unique. The absorption coefficient agrees well with the Urbach rule at $T^* < T < \hbar\omega_0$ and becomes practically independent of temperature at $T < T^*$. At $T > \hbar\omega_0$ the absorption is accompanied by formation of an optical classical fluctuation that has a level of energy $-\Delta$. (12 refs.)

78.20B General theory (for pure homogeneous materials)

Surface modes and optical absorption of a small sphere above a substrate ....See Entry 71050

Comments on the theory of amorphous semiconductors ....See Entry 72295

78.20D Optical constants and parameters

72744 Optical constants of fused silica and sapphire from 0.3 to 25 µm. M.L.Lang, W.L.Wolfe (Ball Brothers, Boulder, CO, USA).
Appl. Opt. (USA), vol.22, no.9, p.1267-8 (1 May 1983).
The optical constants of fused silica and sapphire have been measured in regions where they are transparent and where they are opaque—from 0.3 to 50 µm. The technique used was the Kramers-Kronig method whereby the complex reflectivity (reflectance) was measured at normal incidence over the entire spectrum. A study of the data for the optical constants n and k of fused silica shows a strong absorption band centered at ~9 µm and a strong refractive-index peak just short of 10 µm. This is consistent with the well-known reststrahlen peak of quartz. A second strong and broader peak occurs at 22 µm, and the corresponding refractive-index peak is at ~24 µm. The corresponding two curves for sapphire show that absorption occurs in two strong lines at ~18 and ~24 µm with subsidiary peaks at ~16 and ~19 µm. There are corresponding strong index peaks. The measurements seem to be of satisfactory accuracy. (10 refs.)

72745 Photo-induced changes of optical properties in noncrystalline As-S system films. Sheng Lian-gen, Chen Xue-xian, Xiao Jia-ning, Chen Ju-fang (Shanghai Inst. of Ceramics, Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.149-54 (Jan.-March 1983). [received: May 1983]
The changes in optical properties of As-S films with different compositions during exposure to Ar^+ laser light have been studied. The experimental results show that the photo-induced change of the optical properties is a volume effect and is the largest for As_2S_3 film (among various As/S ratios). The kinetics of the structural change is discussed. The refractive index variations in an as-deposited As_2S_3 film at annealing-exposure cycles have been studied. The reversible part of the variation is determined to be about 0.03, and the irreversible about 0.1. (20 refs.)

72746 Optical and other physical properties of fluorophosphate glass containing $Al(PO_3)_3$. Jiang Yasi, Jiang Fusong, Gan Fuxi (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.162-8 (Jan.-March 1983). [received: May 1983]
Fluorophosphate glass has found applications as optical glass and laser material. In the present work, the optical and other physical properties of the fluorophosphate glass containing $Al(PO_3)_3$ have been investigated and the results are then correlated with the glass structure. The low $Al(PO_3)_3$ content fluorophosphate glass, in which the network structure has been heavily destroyed (the destroyed region), the variation of the glass properties, and the effect of various fluorides on the properties are similar to those of the oxide glass in destroyed region. The special role of LiF, MgF_2, AlF_3 is also reflected on the variation of the physical properties. Comparisons with silicate and borate glasses with high contents of glass formers have indicated that the electrostatic attraction between cations and anions plays more important role in the variation of the properties of the fluorophosphate glass with low $Al(PO_3)_3$ content. The position of the studied glass in the n_d vs. ν diagram is plotted, the partial properties of the studied glass are given and compared with some literature data, and the variation of the partial properties has been related to the $Al(PO_3)_3$ content. (12 refs.)

72747 Refractive index increment of polymers in ternary systems with special reference to diffusion measurements. R.Rymden, J.Carlfors (Inst. of Phys. Chem., Univ. of Uppsala, Uppsala, Sweden).
Polym. Commun. (GB), vol.24, no.4, p.114-17 (April 1983).
A study was made of how the refractive index increment dn/dc, of hydroxypropyl cellulose (HPC) and sodium carboxymethyl cellulose (NaCMC) in aqueous solution is affected by the addition of various glucose derivatives. It was found that dn/dc of HPC decreased with addition of a third component while dn/dc of NaCMC was unaffected. These findings are relevant in connection with diffusion of probe molecules in polymer solutions when using optical methods to monitor the relaxation of the initial concentration gradient. (11 refs.)

72748 Non-linear refraction in magnetised III-V semiconductors. P.K.Sen (Dept. of Phys., Heriot-Watt Univ., Edinburgh, Scotland).
J. Phys. C (GB), vol.16, no.13, p.2603-10 (10 May 1983).
Using the coherent radiation-exciton interaction model, the phenomenon of non-linear refraction has been investigated analytically in the important III-V semiconductors duly irradiated by laser beams with photon energies in the vicinity of the crystal band edges in the presence of a large steady magnetic field. Phenomenological introduction of a damping constant is shown to explain the saturation mechanism. The results can be compared with those obtainable from the direct saturation model. (20 refs.)

72749 The temperature dependence of the refractive indices of fused silica and crystal quartz. T.Toyoda, M.Yabe (Fuji Electric Corporate Res. & Dev. Ltd., Nagasaka, Yokosuka City, Japan).
J. Phys. D (GB), vol.16, no.5, p.L97-100 (14 May 1983).
The temperature dependence of the refractive indices of high-purity fused silica and crystal quartz was measured in the 450-1600 nm wavelength range and at temperatures from room temperature to 400°C. The average thermal coefficients of the refractive indices of those materials show opposite sign. The wavelength dependence of the coefficient in fused silica is smaller than that in crystal quartz. (4 refs.)

72750 Optical properties of GaAs, GaP, InP, and Si in the 300-1000K temperature range. D.I.Bilenko, O.Ya.Belobrovaya, B.A.Dvorkin, V.D.Tsiporukha.
Opt. & Spectrosc. (USA), vol.53, no.3, p.276-80 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.497-75 (Sept. 1982). [received: May 1983]
The temperature dependence of the refractive index n and absorption coefficient α of common semiconducting materials (GaAs, GaP, InP, and Si) were studied. The experimental results were obtained at wavelengths of 0.6328, 1.15, and 3.39 µ in the 300-1000K temperature range. The essential depen-

dence of the temperature behavior of n and α on the width of the energy gap between Γ and X valleys, on the temperature changes of the electronic spectrum, on alloying, and on the mechanism of carrier scattering are established experimentally and explained. (20 refs.)

72751 Dispersion of the indices of refraction and birefringence of cadmium thiogallate. L.M.Suslikov, Z.P.Gadmashi, D.Sh.Kovach, V.Yu.Slivka.
Opt. & Spectrosc. (USA), vol.53, no.3, p.283-7 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.480-8 (Sept. 1982). [received: May 1983]
Experimental data are presented on the dispersion of the ordinary n_o and extraordinary n_e indices of refraction of cadmium thiogallate obtained by the prism and interference methods in the region of transparency of the compound. The spectral dependence of the birefringence of $CdGa_2S_4$ in the same region of the spectrum is also studied. Intersection of the dispersion curves of n_o and n_e at $\lambda=4882$ Å is a typical feature of the data obtained. Analysis is made on the data using the generalized Wemple-DiDomeniko single-oscillator model. The magnitude and sign of the birefringence of $CdGa_2S_4$ and the potential application of this crystal in nonlinear optics are discussed. (34 refs.)

72752 Optical absorption in single-crystal metastable $(GaAs)_{1-x}(Ge_2)_x$ alloys; evidence for a zinc-blende-diamond order-disorder transition. K.E.Newman, A.Lastras-Martinez, B.Kramer, S.A.Barnett, M.A.Ray, J.D.Dow, J.E.Greene (Univ. of Illinois, Urbana, IL, USA), P.M.Raccah.
Phys. Rev. Lett. (USA), vol.50, no.19, p.1466-9 (9 May 1983).
Single-crystal metastable $(GaAs)_{1-x}(Ge_2)_x$ alloys with $0<x<1$ have been grown on (100) GaAs substrates by use of ultrahigh-vacuum ion-beam sputter deposition. Optical-absorption measurements showed that the direct gap E_0 exhibited a large negative V-shaped bowing as a function of x with a minimum $E_0 \simeq 0.5$ eV near $x=0.3$. A zinc-blende to diamond-lattice order-disorder transition model is proposed as a possible explanation for these results. (15 refs.)

72753 Optical properties of K_2SeO_4 in the vicinity of phase transitions. S.Pacesova, B.Brezina, L.Jastrabik (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Phys. Status Solidi b (Germany), vol.116, no.2, p.645-52 (1 April 1983).
The temperature dependence of the absorption edge of K_2SeO_4 is measured in the range 300 to 4.2K. In this temperature range the dependence of the absorption coefficient on the energy of photons and temperature is described by Urbach's rule. The magnitudes of the band gap obtained are $E^{\parallel}+6.06$ and $E^{\perp}=6.14$ eV for light polarized parallel and perpendicular to the a-axis. The temperature gradient of the band gap $(\partial E/\partial T)^{\parallel,\perp}$ reveals a jump at the paraelectric-incommensurate phase transition $T_2=129.5$K for both polarizations of incident light in agreement with the second-order nature of the phase transition. In the paraelectric phase, phonons with eigenfrequencies $\omega^{\parallel}=218$ cm^{-1} and $\omega^{\perp}=181$ cm^{-1} are interacting with the optical transitions. A switch-over to the optical phonon of frequency $\omega^{\parallel,\perp}=92$ cm^{-1} is observed at T_2 together with the change of the electron-optical-phonon coupling constants indicating the increase of the ionic character of the bonds in the incommensurate phase between the K^+ ions and the $(SeO_4)^{2-}$ tetrahedral groups. (9 refs.)

72754 Optical constants of pure and heavily doped silicon and germanium: electronic interband transitions. L.Vina, M.Cardona (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.356-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The technique of Fourier analysis ellipsometry has been applied to pure and heavily doped n- and p-type Ge and Si (doping up to $\approx 10^{20}$ cm^{-3}) to obtain accurate spectra of ϵ_1 and ϵ_2. The authors have studied the shift and broadening of the E_1 (3.4 eV in Si, 2.1-2.3 eV in Ge) and E_2 ($\sim$4.3 eV in both) with doping. All these peaks shift to lower photon energies and broaden with doping. These shifts amount to $\sim$0.05 eV for dopings of 10^{20} cm^{-3}. The results are discussed in terms of the perturbation produced by the ionized impurities. (11 refs.)

72755 Surface transition regions and visible-near UV optical properties of some semiconductors. D.E.Aspnes (Bell Labs., Murray Hill, NJ, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.359-61 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Spectroscopic ellipsometry is used to investigate transition regions at semiconductor surfaces where the dielectric response is changing from bulk to ambient values. Microscopically rough but atomically clean transition regions are shown to be described by effective medium theory. A comparison for ⟨100⟩, ⟨110⟩, and ⟨111⟩ Si surfaces shows that chemical processing yields lower effective transition region widths than processing in ultrahigh vacuum. Plasma sum rules evaluated from more accurate ϵ data obtained here are compared to earlier calculations in the literature. (8 refs.)

72756 The 'missing' electromagnetic wave and the additional boundary conditions for light in a crystal. S.I.Pekar, V.J.Pipa (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Solid State Commun. (USA), vol.46, no.4, p.363-5 (April 1983).
Light penetrating from vacuum into a crystal gives rise to a non-uniform wave in both media that has not been taken into account up to now. Its wavevector $\mathbf{k}$ normal projection is imaginary and $\mathbf{k}^2=0$. The allowance for this wave makes it for the first time possible in the general case to satisfy all the additional boundary conditions of the additional light wave theory. (4 refs.)

72757 Study of the extinction and scattering of light near the critical point. L.V.Adzhemyan, L.Ts.Adzhemyan, L.Z.Zubkov, V.P.Romanov (Leningrad State Univ., Leningrad, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.295-8 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.539-44 (Aug. 1982). [received: May 1983]
The extinction and scattering of light in the vicinity of the critical stratification point are studied in the strongly opalescing BMOAB-isooctane mixture. Owing to the large scattering coefficient, multiple scattering of light plays a major role practically throughout the whole temperature range studied. An iteration procedure is proposed and used for a combined reduction of the experimental data on the basis of the temperature dependence of the transmitted-light intensity and the light-scattering indicatrix. This reduction permits the critical parameters to be determined with good accuracy and diminishes their variance by several times compared to that attained when the results of each of the experiments are analyzed separately. (5 refs.)

72758 Optics of the blue phase of cholesteric liquid crystals. V.A.Belyakov, V.E.Dmitrenko, S.M.Osadchii (All-Union Res. Inst. for Physicotech. & Radiotech. Measurements, USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.322-30 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.585-600 (Aug. 1982). [received: May 1983]
A theory is developed for the optical properties of the blue phases of cholesteric liquid crystals, with account taken of the symmetry restrictions on their experimentally determined structures. The diffraction features of the optics of blue phases (possible reflections and their polarization properties) are found for all the admissible structures, and their optical properties are analytically described within the framework of the dynamic theory. The experimental data are analyzed. The limitations on the blue phase and on the details of these structures, which follow from the experimental data, are indicated. The importance of optical and particularly polarization measurements for the unambiguous determination of the blue-phase structures are noted, as are the possibilities of using the effects of multiple scattering to extract quantitatively more exact structural information.

72759 Optical properties of KDP and DKDP crystals grown at high rates. V.I.Bespalov, V.I.Bredikhin, V.P.Ershov, V.I.Katsman, N.V.Kiseleva, S.P.Kuznetsov (Inst. of Appl. Phys., Acad. of Sci., Gorki, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1527-8 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2343-5 (Nov. 1982). [received: May 1983]
An investigation was made of the transparency, homogeneity, and optical strength of KDP and DKDP crystals grown at rates much higher (by a factor of 25-30) than usual. A comparison was made with the properties of crystals grown at conventional rates. The results indicated that, in principle, it should be possible to grow in this way crystals suitable for use in quantum electronics. (6 refs.)

72760 Some optical characteristics of powdered tellurites of rare-earth elements. A.L.Voloshina, L.A.Ivanchenko, V.A.Obolonchik, E.S.Lugovskaya (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.728-31 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.53-7 (Sept. 1982). [received: March 1983]
As a result of the crystallization of La tellurite specimens accompanying the raising of heat treatment temperature, the refractive index of the compound increased, isotropic particles with cubic structure symmetry became replaced by grains of long prismatic shape, birefringence appeared, and the refractive index became dependent on orientation. Judged by the character of their reaction with light, compounds of the $Ln_2Te_3O_9$ type may be classed as semiconductors with forbidden zones of widths $h\nu_0 \geq 3.8$ eV. It is shown, taking $La_2Te_3O_9$ as an example, that the heat treatment of air-dry specimens at temperatures above 400°C reduces the width of the forbidden zones of the compounds investigated and increases their light absorption coefficients at photon ernergies $h\nu>4$ eV. (8 refs.)

72761 Electron microscopic and ellipsometric studies on oxidized aluminium layers. P.B.Barna, Z.Bodo, G.Gergely, D.Szigethy (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary), J.Adam, P.Jakab.
Vacuum (GB), vol.33, no.1-2, p.93-7 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Epitaxial and polycrystalline Al thin films were deposited in HV on cleaved mica and glass substrates. The Al films were oxidized by thermal and electrolytic processes. The optical constants n and k of virgin and oxidized Al films have been determined by ellipsometry in the 365-579 nm wave length range at the four intensive Hg lines. The apparent values of n and k of the Al films exhibited some correlations with their microstructure revealed by electron microscopy explaining discrepancies in contradictory literature data. Using the same optical constants for the Al substrate after oxidation, a reasonable agreement of the oxide thickness was found at the four Hg lines, with the refractive index $n_{ox}=1.77$, evaluating the ellipsometric measurements. Ellipsometric studies were completed by reflectance measurements. (14 refs.)

Proceedings of the 16th International Conference on the Physics of Semiconductors .... See Entry 69780

The effects of incorporating fluorine in amorphous germanium-silicon alloy films .... See Entry 72261

Electronic, superconducting, and optical properties of technetium from its augmented-plane-wave band structure .... See Entry 72298

Electronic structure of antiferromagnetic MnTe .... See Entry 72304

Gap states in a-Si:H by photoconductivity and absorption .... See Entry 72356

Anomalous infrared absorption in granular superconductors .... See Entry 72547

Temperature studies of optical properties of cadmium diphosphide crystals .... See Entry 72763

Birefringence and dichroism in Zn_3P_2 .... See Entry 72766

Infrared reflection spectra of gypsum .... See Entry 72809

Light scattering by decorated dislocations in alkali halide crystals .... See Entry 72819

Reflectance spectra and dielectric functions for Ag in the region of interband transitions .... See Entry 72833

Effect of aluminum content on infrared characteristics of BaF_2/ThF_4-containing glasses .... See Entry 72838

Dependence of the gap on hydrogen content in a-Si:H .... See Entry 72846

Optical properties of epitaxial $PbS_{1-x}Se_x$ films .... See Entry 72881

Dielectric dispersion in optical electron transfer in solution ..... See Entry 72944

The relationship of oxide film thickness and composition on titanium to the absorption coefficient on laser irradiation in an oxidizing atmosphere .... See Entry 73255

78.20E Optical rotatory power

72762 Optical activity and circular dichroism spectra of pure and deuterated Rochelle salt crystals. M.Koralewski, M.Mroz (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.507-17 (April 1983).
Presents the UV absorption, optical rotatory dispersion (ORD) and circular dichroism (CD) spectra of pure and deuterated Rochelle salt single crystals and aqueous solutions within the UV and visible region. Similar results for tartaric acid crystals and its aqueous solution are included for comparison. The interpretation of the observed ORD and CD bands is given together with the origin of optical activity (OA) of the compounds under investigation.

Also, the relation between OA and spontaneous polarization, P_s is discussed. (28 refs.)

72763 Temperature studies of optical properties of cadmium diphosphide crystals. V.G.Fedotov, A.G.Bychkov, D.N.Karlikov, L.M.Gorynya, A.U.Sheleg, E.M.Smolyarenko, Z.K.Orlik (Inst. of Phys. of Solids & Semiconductors, Acad. of Sci., Minsk, Belorussian SSR).
Phys. Status Solidi a (Germany), vol.76, no.1, p.121-6 (16 March 1983).
The natural optical activity (NOA) and the refractive index are measured in the temperature intervals of 4.2 to 400K and of 293 to 400K, respectively. The dispersion of the NOA is best approximated by a single-term Drude formula. The parameters of dispersion formulas are given for various temperatures. A temperature dependence of NOA in CdP_2 is found. The temperature variation of the CdP_2 rotational ability is shown to be mainly due to the temperature shift of the corresponding optically active band at E=2.4 eV. In the 360 to 380K temperature range a break is observed in the temperature dependence of the specific rotation and the refrative index, while the temperature dependence of the gyration tensor component displays a characteristic feature with well defined maxima, which indicates the presence of a phase transition in CdP_2 crystals in this temperature range. (11 refs.)

Polarization instability in a light wave in a highly nonlinear medium .... See Entry 71174

78.20F Birefringence

(inc. stress birefringence, flow birefringence, etc)

72764 Molecular quadrupole moment and effective-quadrupole-centre of fluorobenzene. G.R.Dennis, I.R.Gentle, G.L.D.Ritchie (School of Chem., Univ. of Sydney, Sydney, New South Wales, Australia).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.529-38 (April 1983).
Measurements of the infinite-dilution molar field-gradient birefringence constant, Kerr constant and Cotton-Mouton constant of fluorobenzene as a solute in carbon tetrachloride at 25°C and at two visible-spectrum wavelengths (441.6 and 632.8 nm) are reported. Analysis of the observations, in conjunction with other known electric and magnetic properties of fluorobenzene, yields the out-of-plane component of the molecular quadrupole moment relative to the effective-quadrupole-centre, establishes that at both wavelengths the effective-quadrupole-centre is close to the centre-of-ring, and permits the evaluation of a combination of elements of the dipole-quadrupole polarisability, **A**, and the optical-activity tensor, **G′**. A complete, though approximate, specification of the centre-of-mass quadrupole moment can be obtained by invoking reasoning due to Shoemaker and Flygare (1969); the result ($\Theta_{xx}/10^{-40}$ C m^2, $\Theta_{yy}/10^{-40}$ C m^2, $\Theta_{zz}/10^{-40}$ C m^2) now found (-1.5 ± 2.9, 22.5 ± 2.7, -21.0 ± 1.0) is at variance with that from the microwave Zeeman effect of this molecule (-6.3 ± 2.7, 17.0 ± 5.0, -10.7 ± 5.0). (33 refs.)

72765 Field-gradient-induced birefringence in dilute solutions of furan, thiophen and selenophen in cyclohexane. G.R.Dennis, I.R.Gentle, G.L.D.Ritchie (School of Chem., Univ. of Sydney, Sydney, New South Wales, Australia), C.G.Andrieu.
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.539-45 (April 1983).
Measurements of the infinite-dilution molar field-gradient birefringence constants, Kerr constants and Cotton-Mouton constants of furan, thiophen and selenophen as solutes in cyclohexane at 298K and 632.8 nm are reported. Analysis of the observations, in conjunction with other known electric and magnetic properties of these molecules, yields for each the out-of-plane component of the quadrupole moment relative to the effective-quadrupole-centre. Combination of these results with centre-of-mass quadrupole moments from microwave Zeeman spectroscopic studies leads to low-precision estimates of the position of the effective-quadrupole-centre and of the relevant combination of elements of the **A** and **G′** tensors. (38 refs.)

72766 Birefringence and dichroism in Zn_3P_2. Z.Gumienny, M.Kiwus, J.Misiewicz (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.419-26 (1982).
Birefringence and dichroism measurements in Zn_3P_2 at 10, 80 and 300K are described. A simple theoretical model is used to explain the results obtained. (8 refs.)

Influence of the internal stresses in the YAG:Nd active material on the power of a pulsed laser .... See Entry 71131

Birefringent filter temperature sensor .... See Entry 71221

The circular dichroism of cholesteric cellulose acetate solutions; dependence on molecular weight .... See Entry 71869

Pretransitional behavior of 8-12 CB .... See Entry 71870

Order parameters for isomeric phenyl substituted anthraquinone dyes dissolved in nematic liquid crystals mixtures—influence of the host .... See Entry 71872

Dispersion of the indices of refraction and birefringence of cadmium thiogallate .... See Entry 72751

Some optical characteristics of powdered tellurites of rare-earth elements .... See Entry 72760

Optical activity and circular dichroism spectra of pure and deuterated Rochelle salt crystals .... See Entry 72762

78.20H Piezo-, elasto- and acousto-optical effects

72767 Nonlinear photoelasticity of crystals in the exciton resonance region. R.A.Ayukhanov, Yu.V.Gulyaev, G.N.Shkerdin (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1402-3 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2174-6 (Dec. 1982). [received: May 1983]
When the frequency of light approaches the resonance absorption region of an insulator, the linear photoelasticity coefficients increase strongly and the effect is particularly important in the exciton absorption region. The authors study the nonlinear photoelasticity in the case of resonance involving exciton states. (8 refs.)

72768 On the nature of piezooptical coefficient temperature anomalies in triglycine sulphate group crystals. B.G.Mytsyk, N.A.Romanyuk.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.538-42 (April 1983). In Russian.
Temperature dependences of piezooptical coefficients have been determined for triglycine sulphate with an analysis of the estimated anomalies. The role of elasticity in the piezooptical experiment and the spectral dependence of the piezooptical constants are discussed. (10 refs.)

Analysis of the soft mode behaviour in $Li_2Ge_7O_{15}$ in terms of a coupled-mode model .... See Entry 72789

Resonant Brillouin scattering in GaAs—linewidth measurements and the effect of stress .... See Entry 72825

Observation of the internal luminescence of $Cr^{2+}(3d^4)$ in GaAs under hydrostatic pressure .... See Entry 72866

78.20J Electro-optical effects

72769 Electroabsorption by Stark effect on room-temperature excitons in GaAs/GaAlAs multiple quantum well structures. D.S.Chemla, T.C.Damen, D.A.B.Miller (Bell Labs., Holmdel, NJ, USA), A.C.Gossard, W.Wiegmann.
Appl. Phys. Lett. (USA), vol.42, no.10, p.864-6 (15 May 1983).
The authors report the first observation of electroabsorption in GaAs/GaAsAs multiple quantum well structures. They have been able to induce Stark shifts for room-temperature excitation resonances of ~10 meV for applied field $\sim1.6\times10^4$ V/cm in a sample with 96-Å GaAs layers, giving large changes in optical absorption (e.g., a factor of 5 or $\sim4\times10^3$ cm^{-1} increase). This should permit optical modulators with micron path lengths and potentially very fast operation. (8 refs.)

72770 Electro-optic effects of (Pb, La)(Zr, Ti)O_3 thin films prepared by RF planar magnetron sputtering. H.Adachi, T.Kawaguchi, K.Setsune, K.Ohji, K.Wasa (Central Res. Labs., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Appl. Phys. Lett. (USA), vol.42, no.10, p.867-8 (15 May 1983).
Epitaxial(Pb, La)(Zr, Ti)O_3 thin films were grown successfully on (0001) sapphire substrates at below 600°C. High quadratic electro-optic coefficient of 0.8×10^{-16} (m/V)^2 was also obtained at 6328 Å. The RF planar magnetron sputtering progress improved the quality of the film, which will be suitable for thin-film integrated optic devices. (8 refs.)

72771 Electroabsorption in chromium-doped *p*-type GaAs. V.A.Morozova, V.V.Ostroborodova, V.N.Sheremet'ev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1394-5 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2162-4 (Dec. 1982). [received: May 1983]
The published information on the energy position of the first acceptor (1A) level of Cr in GaAs is extensive but contradictory: $\epsilon_{1Ac}\approx0.52$-$0.86$ eV. The authors determine the ionization energy of the 1A level of Cr from the electromodulation spectra. (15 refs.)

Order parameters for isomeric phenyl substituted anthraquinone dyes dissolved in nematic liquid crystals mixtures—influence of the host .... See Entry 71872

Unified theory of the electronic Stark effect in molecular crystals .... See Entry 72362

Field-gradient-induced birefringence in dilute solutions of furan, thiophen and selenophen in cyclohexane .... See Entry 72765

Quasi-elastic light scattering of Carnauba wax in the liquid phase: dynamics. I .... See Entry 72816

78.20L Magneto-optical effects

72772 Magnetic circular dichroism of colour centres in CaF_2:Na. J.L.Doualan, J.Margerie, F.Martin-Brunetiere (Lab. de Spectroscopie Atomique, Univ. de Caen, Caen, France), E.Rzepka.
J. Phys. Lett. (France), vol.44, no.10, p.L375-85 (15 May 1983).
The magnetic circular dichroism (MCD) of several centres in additively coloured CaF_2:Na has been measured as a function of temperature in the 1.65-195K range. The 612, 435 and 382-385 nm bands display significant paramagnetic MCD signals, which proves that they most probably arise from centres with an odd number of electrons. Thus 612 nm cannot be only a transition of the [1,0,0] oriented F_{2A} centre, as currently assumed. On the other hand, the 490 nm band only shows a diamagnetic MCD. The authors tentatively discuss some possible assignments for the chief absorption bands of colour centres in CaF_2:Na, but further work using complementary techniques is clearly necessary before one comes to a reliable conclusion. (13 refs.)

72773 Mixed rare-earth iron garnet for magneto-optic devices. O.Kamada, Y.Tsujimoto (Central Research Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.163-9 (Feb. 1983). In Japanese.
Magneto-optic materials for optical current (magnetic field) sensors with high sensitivity and temperature stability are required. Based on a simple theoretical calculation, new mixed rare-earth garnet crystals, $(Tb_xY_{1-x})_3Fe_5O_{12}$, have been proposed and the crystal growth has been performed by a conventional flux method. By Verdet constant measurements of the crystals, it was found that crystals with a component of x=0.19 show a minimum temperature dependence of ±1% between 300~400K. This result agrees well with the theoretical estimation. The characteristics such as sensitivity and linearity of magneto-optical effect were measured. (5 refs.)

72774 Diffraction of light in magnetooptic media with a band domain structure. D.I.Sementsov, A.P.Gubarev.
Opt. & Spectrosc. (USA), vol.53, no.3, p.295-8 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.501-6 (Sept. 1982). [received: May 1983]
Equations are obtained for magnetooptic diffraction (MOD) of light in media with a band domain structure, valid in the region $\sin\psi_0\ll1$ and $D\gg\lambda$. The character of the diffracted field is investigated for sinusoidal and binary distributions of the Faraday component of the magnetization in the two limiting cases of Raman-Nath and Bragg diffraction. It is shown that in the Raman-Nath region the results of solving the MOD equations found in the paper coincide with the results obtained within the framework of Fresnel-Kirchhoff theory for magnetooptic transparencies; for $\theta_F L\lesssim6°$ the efficiencies of Raman-Nath $\eta_{+1}{}^{RN}$ and Bragg $\eta_{-1}{}^{B}$ diffraction turn out to be identical. Because of the presence of a connection between the thickness and period of the domain structure of magnetic crystals the thin-layer condition $L\ll D^2/\lambda$ assumes the form $\Lambda\gg\lambda$, and Λ is the characteristic length of the material. (14 refs.)

72775 Magnetic bias field generator design for the measurement of magnetic garnet film properties using Faraday rotation. M.Kharboush, J.C.Cho (Electrical & Computer Engng. Dept., Louisiana State Univ., Baton Rouge, LA, USA).
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.36-40
A specially designed magnetic bias field generator was constructed. It provides uniform field perpendicular to the sample and varies from zero to 120 oersteds. Spacing is provided to allow a magnetic probe to be placed on the

magnetic garnet sample so that domain cutting experiments can be performed. Pictures were taken by use of Faraday rotation. (2 refs.)

Measuring small AC Faraday rotation: a novel method ....See Entry 70104

Stimulated emission from shallow donors localized by a strong magnetic field ....See Entry 71126

Pretransitional behavior of 8-12 CB ....See Entry 71870

Far-infrared studies of the bound and free carriers in n-InSb as a function of hydrostatic pressure ....See Entry 72347

Optical alignment of the bound electron-nuclear spin system of a semiconductor ....See Entry 72705

Effect of the field due to optically aligned electrons in a semiconductor on the polarization of nuclei in an inclined magnetic field ....See Entry 72707

Optical detection of EPR using the luminescence emitted by crystal defects ....See Entry 72714

Giant spin splitting of exciton states and optically detected magnetic resonance in A^2B^6 crystals containing magnetic impurities ....See Entry 72715

Molecular quadrupole moment and effective-quadrupole-centre of fluorobenzene ....See Entry 72764

Magnetic electronic Raman optical activity of osmium (IV) hexabromide, iridium (IV) hexachloride and uranocene ....See Entry 72797

Momentum resolved polariton spectroscopy in CuBr in the presence of magnetic field ....See Entry 72805

Studies of EPR, spin, and phonon kinetics in parametic ionic crystals using Mandel'shtam-Brillouin and Raman scattering of light ....See Entry 72817

Effect of spin polarization, spin reorientation, and spin-lattice relaxation on the luminescence emitted by alkali-halide crystals at very low temperatures ....See Entry 72843

Optical alignment in semiconductors ....See Entry 72844

78.20N Thermo-optical effects

72776 Thermoreflectance spectra of [1,6-di (*N*-carbazolyl)-2,4-hexadiyne] (DCHD) polymer single crystal. I.Davoli, S.Stizza, V.Prantera (Inst. of Phys., Univ. of Camerino, Camerino, Italy), R.Jankowiak, J.Kalinowski.
Acta Phys. Pol. A (Poland), vol.A63, no.4, p.571-4 (April 1983).
The results are described of thermoreflectance (TR) spectra measurements in DCHD polymer single crystal. The relation between reflectance (R) and TR spectra at room and low temperature is different than that found recently for PDA-TS polymer crystal. This is not understood but some possible reasons of the difference are suggested. (13 refs.)

72777 Thermoreflectance test of W, Mo, and paramagnetic Cr band structures. E.Colavita (Istituto di Fisica 'G. Marconi', Univ. degli Studi di Roma, Roma, Italy), A.Franciosi, C.Mariani, R.Rosei.
Phys. Rev. B (USA), vol.27, no.8, p.4684-93 (15 April 1983).
The authors present a systematic investigation of the electronic structure of W, Mo, and paramagnetic Cr. Thermoreflectance has been used to test the most recent band-structure calculations. Analysis of the systematic trends and improvement of the experimental method allowed them to identify a number of new critical-point and Fermi-surface transitions. An unambiguous interpretation is given for most optical-absorption features in the $0.5<h\nu<5.0$ eV photon-energy range. (34 refs.)

Birefringent filter temperature sensor ....See Entry 71221

78.30 INFRARED AND RAMAN SPECTRA AND SCATTERING

72778 Infrared and Raman spectra and X-ray diffraction studies of solid lead(II) carbonates. M.H.Brooker (Dept. of Chem., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada), S.Sunder, P.Taylor, V.J.Lopata.
Can. J. Chem. (Canada), vol.61, no.3, p.494-502 (March 1983).
Four basic lead carbonates were prepared and identified by X-ray powder diffractometry. These were hydrocerussite ($Pb_3(OH)_2(CO_3)_2$), plumbonacrite ($Pb_{10}O(OH)_6(CO_3)_6$), and the two adducts $MOH.2PbCO_3$ (M=Na, K). New diffraction data are presented for the latter two compounds; they both have primitive hexagonal lattices with two formula units per unit cell. The unit cell dimensions of the sodium and potassium compounds are $a=5.273\pm0.002$ Å, $c=13.448\pm0.005$ Å and $a=5.348\pm0.002$ Å, $c=13.990\pm0.005$ Å, respectively. Six possible space groups are discussed. Raman and infrared spectra are reported for all four compounds, and compared with those of cerussite ($PbCO_3$); assignment of the spectral features is discussed. Vibrational spectra of the two MOH adducts indicate that they are isostructural, and that the structure contains a well-defined lead sub-lattice, consistent with the X-ray data. The spectra of hydrocerussite and plumbonacrite indicate that lead is present as oxygen-bridged polymeric moieties in these solids. The carbonate ions occupy two and three independent sites in hydrocerussite and plumbonacrite, respectively. (43 refs.)

72779 Polarized Raman spectra of an oriented single crystal of barium nitrite monohydrate. O.P.Lambda, H.D.Bist, Y.S.Jain (Dept. of Phys., Indian Inst. of Technol., Kanpur, India).
Can. J. Chem. (Canada), vol.61, no.3, p.608-12 (March 1983).
The symmetries of the observed Raman lines in the 4000-30 cm^{-1} region in different orientations of a single crystal of $Ba(NO_2)_2.H_2O$ have been determined and the spectra have been analysed in terms of the phonons originating from the internal modes of the NO_2^- and H_2O groups and the external lattice modes. The longitudinal-optical and transverse-optical (LO-TO) splittings arising from the Coulomb forces in the crystal are reported for the first time. (15 refs.)

72780 Effects of underpotentially deposited Tl and Pb submonolayers on the surface-enhanced Raman scattering (SERS) from pyridine at Ag electrodes. T.Watanabe, N.Yanagihara, K.Honda (Dept. of Synthetic Chem., Faculty of Engng., Univ. of Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan), B.Pettinger, L.Moerl.
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.649-55 (29 April 1983).
SERS from pyridine on an Ag electrode is almost completely quenched by underpotential deposition of Tl to a surface coverage of $\approx3\%$. Removal of Tl by anodic stripping does not restore the original SERS intensity. These results suggest that only a small fraction of adsorbed pyridine molecules is SERS active, and Tl is specifically deposited on such a SERS active site, which then undergoes irreversible destruction. Pb appears to be non-specifically deposited on the Ag surface, but exhibits a similar irreversible quenching of SERS. (21 refs.)

72781 Raman spectra and staging of intercalated graphite fibers. P.Kwizera, M.S.Dresselhaus (Center for Materials Sci. Engng., MIT, Cambridge, MA, USA), G.Dresselhaus.
Carbon (GB), vol.21, no.2, p.121-9 (1983).
Raman spectra of graphite fibers intercalated with K, Rb and Cs are reported. X-Ray diffraction is used to characterize the fibers with respect to staging. The authors report results mainly for GY70, a highly graphitic commercially available fiber, which is polyacrylonitrile (PAN) based, and some results on UC4104B, a pitch-based fiber. These two fibers have different structures; ideally the GY70 consists of graphite layers parallel to the fiber surface, while UC4104B has graphite planes perpendicular to the surface. X-ray diffraction, using the Debye-Scherrer method shows that these fibers stage, though compounds of mixed stages are generally obtained. The Raman results, which are sensitive to the staging within an optical skin depth, show for the alkali metal donor-intercalated fibers the 560 cm^{-1} line characteristic of stage 1 compounds, the E_{2g2} bounding layer mode characteristic of stage 2, as well as the interior and bounding layer splitting of the E_{2g2} mode, observed in high stage intercalated graphite. In addition, a Raman line near 1355 cm^{-1} is observed, characteristic of less ordered graphites. (23 refs.)

72782 A Raman spectroscopic study of the plastically crystalline state of organic compounds. S.Ganguly, H.R.Swamy, C.N.R.Rao (Solid State & Structural Chem. Unit., Indian Inst. of Sci., Bangalore, India).
J. Mol. Liq. (Netherlands), vol.25, no.2, p.139-47 (April 1983).
The depolarized and polarized components of internal Raman bands of succinonitrile, t-butyl chloride and t-butyl bromide in their plastic crystalline and liquid phases have been analyzed to obtain rotational and vibrational correlation functions. The rotational correlation times are continuous through the plastic-liquid transition and show an Arrhenius behaviour, from which activation energies for rotation have been calculated. Vibrational correlation times are nearly constant in the range of temperature investigated, except for a small change near the plastic-liquid phase transition temperature. (22 refs.)

72783 Consideration of the vibrational properties of germanium dichalcogenides on base of vibrational properties of GeX_4 (X=S,Se) tetrahedra. Z.V.Popovic (Inst. of Phys., Belgrade Univ., Beograd, Yugoslavia).
Fizika (Yugoslavia), vol.15, no.1, p.11-27 (Jan.-March 1983).
Vibrational properties of the single crystals GeS_2 and $GeSe_2$ have been analysed on the ground of the properties of their crystal structure (the basic building blocks in GeX_2 are GeX_4 tetrahedra, which are interconnected via common edge or a common corner). The authors have analysed the Raman and infrared spectra of an isolated GeS_4 tetrahedra, of single crystals $SnGeS_3$ and $PbGeS_3$, (whose GeS_4 tetrahedra are connected via common corners), then the Raman spectra of a Ge_2S_6 molecule, (built of two GeS_4 tetrahedra connected via common edge) and the Raman and infrared spectra of $a-$ of and $c-GeX_2$. It has been concluded that molecular vibrations of the variously connected GeX_4 tetrahedra are not only present in the single crystals GeS_2 and $GeSe_2$, too, but they also play a dominant role in vibrational properties of the germanium dichalcogenides. (26 refs.)

72784 The enhancement of Raman scattering, resonance Raman scattering, and fluorescence from molecules adsorbed on a rough silver surface. D.A.Weitz, S.Garoff (Exxon Res. & Engng. Co., Linden, NJ, USA), J.I.Gersten, A.Nitzan.
J. Chem. Phys. (USA), vol.78, no.9, p.5324-38 (1 May 1983).
The enhancements of normal Raman scattering, resonance Raman scattering, and fluorescence from molecular adsorbed on identical, well-characterized, silver-island films are reported. The enhancement arises from the electromagnetic interaction between the molecules and the electronic plasma resonance of the silver islands. A hierarchy of enhancement ratios is found, with typical values of 10^5 for RS, 10^3 for RRS and 10^{-1} to 10 for fluorescence, depending on the quantum yield of the molecular fluorescence. A model, developed on heuristic grounds and substantiated using the density matrix formalism, describes the light scattering processes and the effects of the plasma resonance. This model presents a unified picture of the surface-induced enhancement effects and is consistent with the experimental values. The comparison of all the forms of optical scattering leads to a complete determination of the role of the plasma resonances in the various portions of the scattering process. The excitation of the electronic plasma resonance results in an increased local field at the molecules leading to an increased excitation or absorption rate. Similarly, the excitation of the plasma resonance by the molecular emission dipole results in an increase in the radiative decay rate. However, the electromagnetic coupling of the molecule to the plasma resonance also adds an additional damping channel which can result in a reduction of the absorption or excitation rate as well as the emission yield. The resultant balance of these processes leads to the hierarchy in the measured enhancements. The hierarchy of enhancements is also shown to have important spectroscopic consequences. (39 refs.)

72785 Vibrational spectroscopy at high pressures. XL. A Raman study of manganese rhenium decacarbonyl. D.M.Adams (Dept. of Chem., Univ. of Leicester, Leicester, England), I.O.C.Ekejiuba.
J. Chem. Phys. (USA), vol.78, no.9, p.5408-12 (1 May 1983).
$MnRe(CO)_{10}$ undergoes two first-order phase transitions under hydrostatic pressures, at ~7 and ~13 kbar. The Raman spectra have been followed through these transitions and are interpreted in terms of a change of molecular geometry from staggered to eclipsed and back to staggered with increase of pressure. Comments are offered on the assignment of the vibrational spectra of this material. (16 refs.)

72786 An infrared absorption study of LTCVD silicon dioxide. C.Pavelescu, C.Cobianu (R&D Center for Semiconductors, Bucharest, Rumania), A.Vancu.
J. Electrochem. Soc. (USA), vol.130, no.4, p.975-7 (April 1983).
The absorption band at 880 cm^{-1} has been assigned to a Si-H bond in LTCVD silicon dioxide from silane and oxygen and it has been observed that the absorbance decreased with increasing deposition temperature. The authors investigate the behavior of the maximum absorption coefficient corresponding to this band with respect to CVD conditions in order to get an insight in the complex mechanism of silane oxidation. (11 refs.)

72787 Relaxation of electron-phonon system in optically excited quasi-1-D mixed valence crystal Wolffram's red salt. H.Tanino, K.Kobayashi (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1446-56 (April 1983).
Resonance Raman scattering and photo-luminescence in Wolffram's red salt are studied. Together with a Raman line and its overtones due to chlorine vibrations along the chain, a continuous, flat and Raman-like emission is observed in the emission spectra. The latter extends deeply into the band edge and is followed by a prominent luminescence band. These emission bands are explained in terms of the recombination during and after relaxation of a charge transfer excited state to the self-trapped state. Details of the relaxation process are discussed on the basis of experimental results on the spectral shapes, the intensities and the degree of polarisation of the spectra. These

experimental results provide the direct evidences for the characteristic relaxation process in self-trapping in a 1-d electron-phonon system.

72788 Enhanced Raman scattering by two-dimensional array of polarisable spheres. M.Inoue (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan), K.Ohtaka.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1457-68 (April 1983).
Two-dimensional array of dielectric spheres gives rise to prominent peaks in the reflectivity spectrum of light, corresponding to the excitation of the localised modes. The authors demonstrate that these localised modes provide a new possibility of enhanced Raman scattering from a molecule adsorbed on arrayed dielectric spheres. It is found that the enhancement factor of order 10^4 is easily achieved, when the incidence and scattering angles of light are appropriate. By calculating the dispersion relation of the localised modes, the authors show that the excitation of them is clearly the origin of such a large enhancement. They also examine the enhanced Raman scattering for arrayed metallic spheres.

72789 Analysis of the soft mode behaviour in $Li_2Ge_7O_{15}$ in terms of a coupled-mode model. H.Orihara, M.Wada, Y.Ishibashi (Synthetic Crystal Res. Lab., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1478-84 (April 1983).
On the basis of a coupled-mode model, the coupling between a soft mode and another optical mode (called a partner mode) in $Li_2Ge_7O_{15}$ observed by means of Raman scattering is analysed. The observed Raman profiles are satisfactorily fitted to the adopted model. From the results of the fitting it has turned out that both real and imaginary parts of the coupling constant are almost constant over the examined temperature range and the coupling between two modes is mainly through the nondissipative mechanism. High pressure Raman scattering measurements were performed. It was found that there is some difference between the temperature and pressure dependences of the behaviours of the coupled system.

72790 Raman spectra of potassium borogermanate glasses with high B_2O_3 contents. I.N.Chakraborty, R.A.Condrate,Sr. (New York State Coll. of Ceramics, Alfred Univ., Alfred, NY, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C71-2 (April 1983).
Raman spectra were measured and analyzed for K_2O-B_2O_3-GeO_2 glasses containing 85% and 65% B_2O_3. Structural changes, e.g. in the coordination of boron (3 to 4) and germanium (4 to 6), were noted from the spectra when composition was varied. (9 refs.)

72791 Raman spectroscopy of calcium aluminate glasses and crystals. P.McMillan (Dept. of Chem., Arizona State Univ., Tempe, AZ, USA), B.Piriou.
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.221-42 (May 1983).
Solar furnace melting and fast-quench techniques have been used to prepare calcium aluminate glasses from 75 mol.% CaO to 82 mol.% Al_2O_3, which have been studied by Raman spectroscopy. The $CaAl_2O_4$ glass spectrum may be interpreted in terms of a fully-polymerized network of tetrahedral aluminate units, which is depolymerized on addition of CaO component analogous to binary silicate systems. The spectra of glasses with higher alumina content than $CaAl_2$-O_4 may not be simply interpreted and a structural model is proposed which would be consistent with the glass spectra and with observed crystal structures along the $CaAl_2O_4$-Al_2O_3 join. This model suggests formation of highly condensed aluminate tetrahedral on initial addition of alumina, with the appearance of aluminate polyhedra of higher average coordination at higher alumina content. Similar high coordination polyhedral are also suggested for a limited composition range along the CaO-$CaAl_2O_4$ joint. These interpretations are compared with the results of a previous study in the SiO_2-Al_2O_3 glass system. (51 refs.)

72792 Rare-earth titanates and stannates of pyrochlore structure; vibrational spectra and force fields. M.T.Vandenborre (Lab. de Spectrochimie du Solide, Univ. Pierre et Marie Curie, Paris, France), E.Husson, J.P.Chatry, D.Michel.
J. Raman Spectrosc. (GB), vol.14, no.2, p.63-71 (April 1983).
Infrared absorption and polarized Raman spectra of rare-earth titanates with the pyrochlore structure $Ln_2Ti_2O_7$ (Ln=Sm, Gd, Yb; Y) and $Ln_2Sn_2O_7$ (Ln=La, Sm, Gd, Yb, Lu; Y) have been recorded. A valence force field calculation clearly supports the assignment of the frequencies. A comparison of the results with those of homologous zirconates and hafnates is predicted. (20 refs.)

72793 Raman studies of vibrational and reorientational relaxation in rotator phase perfluorocyclohexane. R.T.Bailey, F.R.Cruickshank (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
J. Raman Spectrosc. (GB), vol.14, no.2, p.72-6 (April 1983).
Vibrational and reorientational relaxation have been studied in rotator phase perfluorocyclohexane using Raman line-shape analysis. Two totally symmetric bands were investigated in the temperature range from 170 to 300K. The results were compared with the predictions of the Kubo stochastic line-shape theory. Activation enthalpies for molecular reorientation were consistent with previous NMR results. (21 refs.)

72794 Temperature dependence of the low frequency Raman scattering spectra in tetramethylammonium tetrachlorozincate. J.Henocque, J.L.Sauvajol, J.Lefebvre (Lab. de Dynamique des Cristaux Moleculaires, Univ. des Sci. et Tech. de Lille, Villeneuve d'Ascq, France), G.Marion.
J. Raman Spectrosc. (GB), vol.14, no.2, p.93-5 (April 1983).
The behaviour of some lattice modes in the Raman spectra (wavenumber shift range 0.50 cm^{-1}) has been investigated for $(N(CD_3)_4)_2ZnCl_4$ and $(N(CH_3)_4)_2\ ZnCl_4$ over the temperature range 183-523K. (6 refs.)

72795 Raman and infrared spectra of solid carbon diselenide. B.H.Torrie, B.Andrews, A.Anderson (Guelph-Waterloo Program for Graduate Work in Phys., Univ. of Waterloo, Waterloo, Ontario, Canada), B.M.Powell.
J. Raman Spectrosc. (GB), vol.14, no.2, p.96-8 (April 1983).
Raman and infrared spectra of polycrystalline samples of CSe_2 have been recorded at temperatures from 20-205K. A comparison with previous results for CS_2 shows that the spectra are consistent with the two substances having the same centrosymmetric orthorhombic structure. The observed spectra for CSe_2, in both the lattice and molecular regions, are in good agreement with group theoretical predictions based on this structure. There is only one solid phase over the range of temperatures examined. (12 refs.)

72796 The Raman spectra of manganese and zinc fluorotitanate hexahydrate systems. P.Choudhury, B.Ghosh (Saha Inst. of Nuclear Phys., Calcutta, India), G.S.Raghuvanshi, H.D.Bist.
J. Raman Spectrosc. (GB), vol.14, no.2, p.99-101 (April 1983).
Raman spectra of $ZnTiF_6.6H_2O$ and $MnTiF_6.6H_2O$ single crystals have been observed in different polarizations. The various mode frequencies have been identified by studying the spectra in solution and comparing the data with those on similar systems. (8 refs.)

72797 Magnetic electronic Raman optical activity of osmium (IV) hexabromide, iridium (IV) hexachloride and uranocene. L.D.Barron, J.Vrbancich (Chem. Dept., Univ. of Glasgow, Glasgow, Scotland).
J. Raman Spectrosc. (GB), vol.14, no.2, p.118-25 (April 1983).
Magnetic optical activity is reported in electronic resonance Raman transitions of $OsBr_6^{2-}$, $IrCl_6^{2-}$ and $U(C_8H_8)_2$ in solution. All the effects are observed in the form of couplets which originate in separate Raman transitions between magnetic components of the initial and final levels. These can give detailed information about the magnetic structure of the ground and low-lying electronic states, particularly the sign of the g-factor and the ordering of magnetic sub-states in general. For example, effects in the 466 cm^{-1} electronic Raman band of $U(C_8H_8)_2$ confirm that the $M_J=\pm 4$ level lies below the $M_J=\pm 3$ level. The authors also use the magnetic Raman optical activity to identify a very weak $U(C_8H_8)_2$ Raman band at 675 cm^{-1} with a vibrational-electronic combination transition. (27 refs.)

72798 Precision Raman investigation of the ν_1 mode of vibration of SO_4^{2-}, WO_4^{2-} and MoO_4^{2-} in aqueous solutions of different concentrations. K.J.Dean, G.R.Wilkinson (Wheatstone Phys. Lab., King's Coll., London, England).
J. Raman Spectrosc. (GB), vol.14, no.2, p.130-4 (April 1983).
The ν_1 vibrational Raman modes of the anions SO_4^{2-}, WO_4^{2-} and MoO_4^{2-} have been studied in aqueous solution with great precision, and the effect of different alkali metal cations (Li^+, Na^+, K^+, Rb^+ and Cs^+) carefully recorded as a function of concentration. The results show that the symmetric vibrational frequency of the anions is dependent on both the concentration and on the cation present in the solution. Precise values of the anion ν_1 frequencies were found at infinite dilution by extrapolation. These frequencies are: 980.75 ± 0.1 cm^{-1} for SO_4^{2-}, 931.1 ± 0.1 cm^{-1} for WO_4^{2-} and 986.1 ± 0.1 cm^{-1} for MoO_4^{2-}. When the alkali metal cations Li^+ or Na^+ were present in the solution, the anion ν_1 frequency was shifted to a higher value than the infinite dilution frequency, whereas, when K^+, Rb^+ or Cs^+ were present in the solution, the anion ν_1 frequency was decreased. The frequency shifts were also found to depend linearly on the square root of the solution concentration. The results also indicate that in ionic aqueous solutions the water molecule behaves as though it has a radius of 1.15 ± 0.01 Å and a polarizability of 0.39 ± 0.01 $Å^3$. An empirical relation between cation volume and polarizability has also been demonstrated. (20 refs.)

72799 An examination of the longitudinal acoustic mode of polyethylene crystals (Raman spectra). J.Runt, I.R.Harrison, W.D.Varnell, J.-I.Wang (Dept. of Materials Sci. & Engng., Pennsylvania State Univ., University Park, PA, USA).
J. Macromol. Sci. - Phys. (USA), vol.B22, no.2, p.197-212 (1983).
Chain lengths have been calculated from the peak positions of the longitudinal acoustic modes (LAM) of polyethylene single crystals grown at several different temperatures. The data are consistent with other experimental results when the crystalline elastic modulus is taken to be 3.6×10^{12} dyn/cm^2. However, this is true only if the vibrations of the crystalline chain segments are unaffected by the presence of folds and cilia on the crystal surface. The LAMs of several crystal preparations were also deconvoluted with the first-order LAM of $C_{94}H_{190}$ in order to remove instrumental broadening. The band shapes of the deconvoluted spectra are consistent with the idea that the LAM of polyethylene crystals is composed of two contributions: one due to chain stems in 110 sectors and a second due to chains in 200 sectors. (36 refs.)

72800 Addendum on infrared emission from n-InSb under crossed electric and magnetic fields. T.Morimoto, M.Chiba (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.6, p.343-4 (9 May 1983).
The physical meaning of the infrared emission from InSb generated by the $\mathbf{J}\times\mathbf{H}$ force, especially the activity of the electron-hole system under high magnetic fields, and the relations with other works are discussed. (8 refs.)

72801 Raman scattering in GeS single crystals at low temperatures. V.Vorlicek, I.Gregora, D.Chvostova (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Phys. Status Solidi b (Germany), vol.116, no.2, p.639-43 (1 April 1983).
The Raman spectra of GeS single crystals are investigated in the temperature interval 20 to 300K. The possible origin of new features observed at low temperatures is discussed. A new assignment of the off-diagonal B_{1g} and B_{3g} modes is proposed. (11 refs.)

72802 Polarized Raman spectra of InS single crystal. K.Takarabe, K.Wakamura (Dept. of Natural Sci., Okayama Univ. of Sci., Okayama, Japan).
Phys. Status Solidi b (Germany), vol.116, no.2, p.K79-83 (1 April 1983).
The authors study the polarised Raman spectra of InS single crystals in order to study their crystal structure. They compare the Raman scattering from single crystals with that from twinned crystals. (7 refs.)

72803 Preparation and optical investigation of the $CdInGaS_4$ compound. K.Kambas (Lab. of Phys., Univ. Thessaloniki, Thessaloniki, Greece).
Phys. Status Solidi a (Germany), vol.76, no.2, p.735-41 (16 April 1983).
A method of preparation of the quaternary layer compound $CdInGaS_4$ is proposed to obtain single crystals of good quality for optical measurements. Far-infrared and Raman scattering measurements are performed at room temperature. These results are compared with available FIR and Raman data from the literature of $ZnIn_2S_4$ whose structure is accepted to be identical with that of $CdInGaS_4$. From electron microscopy diffraction patterns it is deduced that there is a superstructure due to a kind of ordering of Ga and In atoms within the layers and to this fact some extra frequencies in the FIR spectrum are attributed. Optical transmission and absorption measurements give an estimation of the optical energy gap (E_g=2.56 eV) at room temperature. (12 refs.)

72804 Local induced activity in resonant Raman scattering of GaP:N. M.P.Dos Santos, C.Hirlimann, M.Balkanski (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.108-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Resonant Raman scattering (RRS) in GaP:N at 5K is performed. By tuning the excitation photon energy through the 1s ground state energy of the exciton bound to NN_3, NN_4 and NN_7 pairs, in addition to the zone center Raman active to: 367 cm^{-1} and LO: 404 cm^{-1} modes, other peaks at 390 and 412 cm^{-1} appear corresponding to the high density of states of the TO (X) and LO (X). Due to the random distribution of N which breaks the momentum conservation these modes become first order Raman active. This result suggests that the intermediate state of the RRS process is now the X contribution of the N trapped exciton. (4 refs.)

72805 Momentum resolved polariton spectroscopy in CuBr in the presence of magnetic field. J.-C.Merle, A.Bivas, C.Wecker, J.-B.Grun (Lab. de Spectroscopie et d'Optique du Corps Solide, Univ. Louis Pasteur, Strasbourg, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.296-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors study the effect of a magnetic field H oriented along [$\bar{1}$10] on the hyper-Raman spectrum obtained in a backward scattering geometry from a [110] surface of a CuBr crystal. They investigate the energy $E(\underline{k},\underline{H})$ of various exciton-like polaritons for a fixed wave vector $\underline{k}$. The energies $E(\underline{k},\underline{H})$ being not symmetric with respect to $\underline{H}$, they conclude that the k-linear term plays an important role in the exciton dispersion. (9 refs.)

72806 Resonant Raman scattering in GaAlAs: first order active and disorder activated phonon lines. Theory of the IR dielectric susceptibility. B.Jusserand, R.Bonneville (CNET, Bagneaux, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.365-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Measurements of resonant first order Raman scattering on optical and disorder activated acoustical phonons in aluminium rich $Ga_{1-x}Al_xAs$ samples in the vicinity of the direct energy gap are reported. A calculation of the infrared dielectric response of $Ga_{1-x}Al_xAs$ using a shell-model and the coherent potential approximation accounts for the display of the optically active vibrations. (3 refs.)

72807 Resonance-Raman scattering and electron-phonon coupling in the cuprous halides. F.Meseguer, J.C.Merle, M.Cardona (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.374-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Resonance Raman scattering is investigated for the copper halides. Values of the Raman tensor, the electron-phonon deformation potential d_0, and the second harmonic generation d_{123} are obtained. (12 refs.)

72808 Vibrational spectra of some rhenium-apatites containing ReO_5-groups. E.J.Baran (Facultad de Ciencias Exactas, Univ. Nacional de La Plata, La Plata, Argentina), G.Baud, J.-P.Besse.
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.383-6 (1983).
The vibrational spectra of a series of compounds of formula $Ba_{10}(ReO_5)_6X_2$ (with X=F, Cl, Br, I, $^1/_2$ CO_3^{2-}) belong to the apatite structural type, as well as that of the defective apatite $Ba_9(ReO_5)_6$, are reported and briefly discussed. The results show that the square pyramidal ReO_3 units present in these lattices possess a very characteristic and well defined pattern. (13 refs.)

72809 Infrared reflection spectra of gypsum. H.Takahashi, I.Maehara, N.Kaneko (Dept. of Chem., Waseda Univ., Tokyo, Japan).
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.449-55 (1983).
Polarized IR reflection spectra of gypsum single crystals have been measured and analysed using the Kramers-Kronig relation. The transverse and longitudinal frequencies are obtained together with the optical and dielectric constants of the crystal. The librational bands of water of crystallization are identified based on the IR spectra of deuterated powders and low-temperature IR spectra. Polarized Raman spectra have also been measured, which agree well with those reported previously. (7 refs.)

72810 Raman scattering in quasi-one-dimensional $ZrTe_5$. I.Taguchi, A.Grisel, F.Levy (Inst. de Phys. Appliquee, EPF-Lausanne, Lausanne, Switzerland).
Solid State Commun. (USA), vol.46, no.4, p.299-303 (April 1983).
Raman scattering experiments on the compound $ZrTe_5$ isostructural with $HfTe_5$ have been performed at temperatures between 300-13K. The Raman spectra of $ZrTe_5$ resemble those of $HfTe_5$ excepting two high frequency modes which should include the most characteristic diatomic mode. In spite of structural similarity with the transition-metal trichalcogenides, the Raman scattering activity cannot be directly compared. These unexpected results and the usual temperature dependence of the Raman intensities suggest the possibility of a structural instability in $HfTe_5$ and/or $ZrTe_5$ in relation with the anomalies in the transport properties and in the X-ray forbidden reflections. (14 refs.)

72811 Photoacoustic and absorption spectra of UF_4. D.T.Hodul (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
Spectrosc. Lett. (USA), vol.16, no.3, p.181-91 (1983).
The author has measured the photoacoustic spectrum of UF_4, extending the previously reported spectrum into the range of 800 nm to 2600 nm. Spectra at cryogenic temperatures were recorded for UF_4 in KBr pellets to assess the role of phonons in the broad spectral features of UF_4. A room temperature PAS spectrum of UO_2 has also been obtained for comparison. These data have been compared with those of Conway (1959) and Hecht and Gruber (1974), and the author has found qualitative agreement between the energies of these prior studies and those obtained in the study. The author interprets the broad spectral peaks observed in UF_4 compared to the narrow features seen in dilution studies as being derived from lower site symmetry of the U^{4+} species and/or uranium-uranium interactions. Shifts in peak maxima are attributed to differences in uranium-anion interaction. (16 refs.)

72812 Infrared observation of intrinsic modes on adsorbent surfaces by photothermal beam deflection spectroscopy. M.J.D.Low, A.G.Severdia, T.H.Arnold (Dept. of Chem., New York Univ., New York, NY, USA).
Spectrosc. Lett. (USA), vol.16, no.3, p.207-14 (1983).
In order to carry out IR work in the window region, very thin and fragile samples requiring fastidious and arduous preparation must be used and exacting measurements at very low IR intensities are required; suffice it to say that such work is extremely difficult with IR transmission methods. The authors propose and demonstrate an easier alternative approach. (6 refs.)

72813 Changes in the optical properties of oxygen in silicon as a result of heat treatment and irradiation. S.L.Olimpiev, V.A.Sutyagin (L.Ya. Karpov Sci.-Res. Physicochem. Inst., Obninsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1431-2 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2211-14 (Dec. 1982). [received: May 1983]
The authors identify all the absorption bands due to oxygen in Si and establish a relationship between the concentration of dissolved oxygen and the behavior of thermal and radiation defects. Irradiation was carried out by various fluxes of fast neutrons when the temperature of a sample did not exceed 50-60°C. Infrared spectra were recorded by a differential method at 80 and 300K. (9 refs.)

72814 Anomalies in the anisotropy of Raman scattering by polar vibrations in CdP_2 crystals. V.P.Grishchuk, A.V.Slobodyanyuk, Z.Z.Yanchuk (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1767-8 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3122-5 (Oct. 1982). [received: April 1983]
The authors have studied the Raman scattering due to polar vibrations of E symmetry in crystals of cadmium diphosphide, CdP_2, which belongs to the axial class 422 and which exhibits significant optical activity. They conclude that for a correct determination of the Raman tensor components in crystals it is necessary to take account of the polarization of the normal waves allowed by the crystal symmetry in the propagation directions of the incident and scattered light, both in the design of the experiment and in the analysis of the results. (12 refs.)

72815 The structure of Raman scattering spectrum for phianite of 0.9 ZrO_2-0.1 Y_2O_3 composition. N.D.Dovga, V.E.Pogorelov.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.530-4 (April 1983). In Russian.
The Raman scattering spectrum is investigated for a single crystal of phianite of 0.9 ZrO_2-0.1 Y_2O_3 composition. The spectrum complication is ascribed to ion vibrations in the structurally disordered oxygen sublattice with anion vacancies. Frequencies and symmetry of normal modes of vibrations are determined. (8 refs.)

Vibrational intensities in infrared and Raman spectroscopy .....See Entry 69802

Spectroscopy of molecular crystals. A bibliography for 1980 ..See Entry 69810

Time-resolved resonance Raman study of transient benzooxazolinic merocyanines ....See Entry 70884

Vibrational spectra of bromocyclopropane ....See Entry 70885

Applications of four-channel Raman difference spectroscopy to studies in hydrogen-bonded systems ....See Entry 70886

Coherent anti-Stokes Raman spectra of isoalloxazines ....See Entry 70887

UV-excited resonance Raman spectra of methyl orange and its complex with cetyltrimethylammonium bromide ....See Entry 70888

Optical absorption spectrum of Pr^{3+} in aprotic $POCl_3$:$SnCl_4$ laser liquid ....See Entry 71115

Enhanced four-wave mixing from silver particles ....See Entry 71182

First investigations of the vitreous crystal phase of 1-cyanoadamantane obtained by quenching of the plastic phase ....See Entry 71882

IR spectra and structures of tellurite glasses ....See Entry 71886

Network structure of sodium and potassium borosilicate glass systems ....See Entry 71890

Study of sodium silicate melt and glass by infrared reflectance spectroscopy ....See Entry 71893

New halide glasses—bromide glasses based on $ZnBr_2$. I. Vitreous zinc bromide ....See Entry 71895

FTIR evidence of β crystal phase formation in PVDF/PMMA blends ....See Entry 71907

Synthesis, structural study by X-rays and by infrared and Raman spectrometry of the basic tellurite Li_2TeO_3.LiOH ....See Entry 71951

Direct evidence for the site of substitutional carbon in GaAs using localised vibrational mode spectroscopy ....See Entry 71983

Order-disorder transitions and solid state reaction kinetics in Na_2SO_4-K_2SO_4 system. I ....See Entry 72098

Conditions for stabilization of carbon monoxide near the surface of KCl and KBr crystals ....See Entry 72250

The effects of incorporating fluorine in amorphous germanium-silicon alloy films ....See Entry 72261

Excitation spectroscopy in silicon: pseudo-acceptor excited states of the isoelectronic A, B, C exciton system ....See Entry 72319

Far-infrared studies of the bound and free carriers in n-InSb as a function of hydrostatic pressure ....See Entry 72347

Test of short range effects in surface enhanced Raman spectroscopy: an elastic tunnelling study of pyridine-metal interfaces ....See Entry 72515

Variations of trap states and dangling bonds in CVD Si_3N_4 layer on Si substrate by NH_3/SiH_4 ratio ....See Entry 72527

Optical constants of fused silica and sapphire from 0.3 to 25 μm ....See Entry 72744

Thermoreflectance test of W, Mo, and paramagnetic Cr band structures ....See Entry 72777

Studies of EPR, spin, and phonon kinetics in parametic ionic crystals using Mandel'shtam-Brillouin and Raman scattering of light ....See Entry 72817

Light scattering from acoustic and low-frequency vibrational modes in borate glasses ....See Entry 72822

Metastable deexcitation spectroscopy and ultraviolet photoemission spectroscopy on electropolymerised polyacrylonitrile layer ....See Entry 72835

Effect of aluminum content on infrared characteristics of BaF_2/ThF_4-containing glasses ....See Entry 72838

New absorption band in the near IR assigned to a bound triplet state of the *F′* in NaI ....See Entry 72839

A new conversion coefficient for oxygen content. Determination in Si by IR absorption ....See Entry 72840

Infrared absorption due to pair modes of the NO_2^- ions doped in KI single crystals ....See Entry 72841

Spectroscopic studies of 450°C thermal donors in silicon ....See Entry 72842

Dependence of the gap on hydrogen content in a-Si:H ....See Entry 72846

Recent progress in characterisation techniques. Development and standardisation of new techniques ....See Entry 72856

Elementary surface excitations in insulators and metals. Methods of spectral examination ....See Entry 72878

Optical properties of epitaxial $PbS_{1-x}Se_x$ films ....See Entry 72881

Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect ....See Entry 72882

Photoemission study of oxygen adsorbed on coldly deposited silver films ....See Entry 72961

Annealing effects in a-Si:H thin films prepared by glow discharge method ....See Entry 73002

The relationship of oxide film thickness and composition on titanium to the absorption coefficient on laser irradiation in an oxidizing atmosphere .... See Entry 73255

In situ Raman spectroscopic studies of the rechargeable low temperature molten salt cell Na/beta″-alumina/S(IV) in $AlCl_3$-NaCl .... See Entry 73431

78.35 BRILLOUIN AND RAYLEIGH SCATTERING

72816 Quasi-elastic light scattering of Carnauba wax in the liquid phase: dynamics. I. L.Fonesca, G.A.Barbosa (Dept. de Fisica, Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Appl. Opt. (USA), vol.22, no.9, p.1409-12 (1 May 1983).
Quasi-elastic light scattering of Carnauba wax in the liquid phase is done in a homodyne setup and is interpreted as due partially to polarized clusters. A dynamics model is proposed, and effective parameters are obtained in the 85-130°C temperature range. Some evidence exists that the local field seen by a polarized cluster is much higher than the applied static electric field. (9 refs.)

72817 Studies of EPR, spin, and phonon kinetics in parametic ionic crystals using Mandel'shtam-Brillouin and Raman scattering of light. S.A.Al'tshuler, B.I.Kochelayev, Yu.G.Nazarov, A.Kh.Khasanov (Kazan State Univ., Kazan, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.1-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.418-22 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Studies the spectral and kinetic parameters of paramagnetic centers and of the phonons interacting with them in a CeMgN crystal, using Mandel'shtam-Brillouin scattering (MBS). Light scattered by Debye waves with frequencies in the region of the electron paramagnetic resonance (EPR) exhibit a frequency shift or even splitting of the fine-structure components of the Rayleigh line. This effect is due to a change in the velocity of sound, resulting from spin-phonon interactions and the onset of collective spin-phonon oscillations under certain definite conditions. Particular attention is devoted to the possibility of direct studies of nonequilibrium states of resonance phonons due to EPR saturation. Raman scattering of light which is of pure spin origin is also studied. In this case, the initial and final states involved in the Raman transition differ by the magnetic spin quantum number. Such transitions are due to indirect spin-photon coupling involving electric dipole and spin-orbital interactions. (17 refs.)

72818 Brillouin scattering study of the anisotropic relaxation of the polarisation fluctuation in ferroelectric TGS. Y.Tsujimi (Hokkaido Univ. of Education, Hakodate, Japan), T.Yagi, I.Tatsuzaki.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1469-77 (April 1983).
The polarisation relaxation phenomena in the uniaxial ferroelectric TGS have been studied by the observation of the angular dependence of the Brillouin scattering spectra. Both the frequency shift and the full width of the Brillouin satellite show remarkable anisotropic anomalies most strongly at 44.94°C below the transition temperature $T_c=48.86°C$. The experimental result is successfully interpreted from the viewpoint of the depolarisation effect on the polarisation fluctuation. The effect is characterised by the anisotropic relaxation time with only two parameters; a relaxation time τ_0 for a transverse polarisation fluctuation and a generalised Lorentz factor L. The values $\tau_0=(0.93\pm0.09)\times10^{-11}$ sec and $L\simeq0.41$ give a good description of the experimental result. (34 refs.)

72819 Light scattering by decorated dislocations in alkali halide crystals. R.Kesavamoorthy, A.K.Arora (Materials Sci. Lab., Reactor Res. Centre, Kalpakkam, India).
J. Phys. C (GB), vol.16, no.13, p.2611-18 (10 May 1983).
The light scattering width of a dislocation decorated with lattice vacancies and impurities in doped alkali halide crystals is calculated. The contributions of the strain fields of dislocation and point defects to the change in dielectric constant are also considered. The calculations show that the decoration does not significantly change the light scattering from dislocations and it is the strain field of the dislocation that contributes most to the light scattering. Recent light scattering data and their interpretations are discussed in the light of the results of the present calculation. (10 refs.)

72820 Brillouin scattering in thin deposited polymer films. R.Zamoni, J.de Valera, G.I.Stegeman, J.F.Rabolt (IBM Res., San Jose, CA, USA).
J. Polym. Sci. Polym. Lett. Ed. (USA), vol.21, no.4, p.253-6 (April 1983).
Brillouin scattering has been proven over the last decade to be a valuable tool for studying the elastic and elasticity-related properties to bulk polymers, i.e. samples of millimeter dimensions. Recently, Dil et al. (1981), observed Lamb waves in submicron polycarbonate films deposited on Pyrex using a tandem multipass Fabry-Perot interferometer. However, it is difficult to deduce the longitudinal wave velocity from Lamb wave velocities which are determined largely by the shear elastic constant of the film. The authors report a unique scattering geometry based on optical guided waves which allowed them to measure longitudinal wave velocities in 1-μm-thick poly(methyl methacrylate) (PMMA), poly(vinyl alcohol) (PVA), and polystyrene (PS) films. (16 refs.)

72821 Brillouin scattering from amorphous polymers at low temperatures. M.Schmidt (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), R.Vacher, J.Pelous, S.Hunklinger.
J. Phys. Colloq. (France), vol.43, no.C-9, p.501-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
For three different polymers (polymethylmethacrylate (PMMA), polystyrene (PS), and polycarbonate (PC)) sound velocity and attenuation of 18 GHz longitudinal phonons were measured in the temperature range from 0.3K to 20K by means of high resolution Brillouin spectroscopy. At the lowest temperatures from 0.3K to 3K all samples showed the characteristic low temperature behaviour of inorganic glasses, i.e. a logarithmic increase of the sound velocity and a decrease of the resonant absorption due to the interaction of phonons with two-level-systems. At higher temperatures (5K to 20K) for all samples, the absorption rises linearly with temperature whereas the sound velocity decreases proportional to T. This behaviour can be related to a thermally activated process. Data are only presented for PMMA as a typical example. (7 refs.)

72822 Light scattering from acoustic and low-frequency vibrational modes in borate glasses. J.Lorosch, M.Couzi, J.Pelous, R.Vacher, A.Levasseur (Lab. de Spectroscopie Infrarouge, Univ. de Bordeaux I, Talence, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.541-3 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Brillouin and low frequency Raman scattering experiments have been performed on series of B_2O_3-xM_2O glasses where M=Li, Na, K, Rb, Cs, T*l*. The concentration and composition dependences of the velocity and attenuation of longitudinal and transversal acoustic waves have been measured, as well as those of the Raman 'boson' peak. The composition and concentration dependence of the acoustic velocity seems to result from two competitive effects: the first one is related to the transition of boron atoms from three to four coordination with increasing x and the second one to the structural changes connected to the sterical hindrance of the M^+ cations. The maximum frequency of the boson peak has a behaviour similar to that of sound velocity. This similarity can be understood on the basis of the continuum theory of low-frequency Raman spectrum. (8 refs.)

72823 Measurements of visual light scattering in glass electrets. E.Rysiakiewcz-Pasek (Inst. of Phys. Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.445-9 (1982).
Presents the results of an examination of visual light scattering in glass samples to which an external electric field is applied. It has been stated that in electret samples the scattering was greater than in samples treated only thermally. On the basis of the light scattering measurements a model of charge distribution in glass electrets is suggested. The optical glasses of the crown group BK-7 and BK-107 were used in the examinations. They are of the following chemical composition: BK-7-68.6% SiO_2, 11.0% B_2O_3, 11.0% Na_2O, 6.0% K_2O, 2.4% BaO, 1.0% As_2O_3, while BK-107 being of the same composition contains additionally 0.2 per cent by weight of CeO_2. (8 refs.)

72824 Phonon selectivity in resonant Brillouin scattering (RBS) from multi-component polaritons. M.Yamane, K.Cho (Faculty of Engng. Sci., Osaka Univ., Toyonaka, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.377-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Phonon selectivity in resonant Brillouin scattering (RBS) from multi-component polaritons in the back scattering geometry is discussed for the deformation and piezoelectric potential interactions in the long wavelength limit. An explicit calculation of RBS intensities is also presented for the parallel ($e_i//e_s$) and cross ($e_i\perp e_s$) polarized back scatterings from CuBr[$Z_{1,2}$] for k//[111], with assumed ABCs in a generalized Pekar form. (17 refs.)

72825 Resonant Brillouin scattering in GaAs—linewidth measurements and the effect of stress. R.Sooryakumar, P.E.Simmonds (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.380-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Five pass Fabry Perot interferometry is used to study the linewidths of exciton-polaritons resonant Brillouin scattered by phonons in GaAs. Both inter- and intra branch peaks are measured. An interpretation of the results in terms of excitons with an energy independent damping is shown to be inadequate for GaAs. The effect of stress is investigated and the observed decrease in masses of the stress decoupled excitons is in agreement with calculations based on experimental band parameters. (8 refs.)

72826 Diffraction properties of the classical superlattice of nonequilibrium carriers in a small modulation-amplitude semiconductor. L.A.Prokhnitskii.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.525-30 (April 1983). In Russian.
Light diffraction by a semiconductor superlattice is considered in a heating electric field. The superlattice is formed by a periodically modulated electron density. The heating electric field is shown to significantly influence the diffracted wave intensity. This phenomenon can be used in principle for controlling the energy redistribution between the main and diffracted waves in transmitted light. (13 refs.)

Multidetector scattering as a probe of local structure in disordered phases .... See Entry 71864

Light scattering from nematic liquid crystals in a nonuniform velocity field .... See Entry 71874

Glass-like anomalies in the hypersonic properties of OH^- doped KCl crystals .... See Entry 72062

The effect of structural disorder on phonon lifetimes .... See Entry 72072

Study of the extinction and scattering of light near the critical point .... See Entry 72757

78.40 VISIBLE AND ULTRAVIOLET SPECTRA

72827 The oblique incidence *P*-wave reflection spectra of the cleavage surfaces of $MgCl_2$ crystals. S.Kinno, R.Onaka (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1485-8 (April 1983).
The reflection spectra of $MgCl_2$ single crystals having a uniaxial layer structure are studied with *p*-polarised light obliquely incident upon the cleavage surfaces. From the comparison between the experimental facts obtained from the reflection spectra and the electronic band structure calculated theoretically, it is confirmed that the top of the valence band belongs to Γ_3^- and a Γ_2^- state lies just below this.

72828 Blue shifts of the optical transitions in MnO below T_N. M.S.Seehra, R.D.Groves (Phys. Dept., West Virginia Univ., Morgantown, WV, USA).
J. Phys. C (GB), vol.16, no.13, p.L411-16 (10 May 1983).
The temperature dependence of the optical transitions (A, B and C bands) in MnO was measured between 27 and 295K, with particular attention to the region near $T_N\simeq118K$. All three bands undergo blue shifts below T_N, with the total shift $\Delta E\simeq1\%$ between T_N and 27K. Using the Penn model for dielectric constant, it is argued that the observation of $\sqrt{\Delta E}$ being proportional to σ (order parameter) for the A and B band is consistent with the dielectric anomaly reported recently in MnO below T_N. (15 refs.)

72829 Excitonic effects in the interband spectra of metals. A.B.Kunz, C.P.Flynn (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1524-7 (9 May 1983).
It is shown that Coulomb interactions among quasiparticles can play a determining role in the interband optical transitions of polyvalent metals. Explicit calculations for Mg metal made by configuration-interaction methods greatly improve upon the results of single-particle self-consistent-field calculations. (12 refs.)

72830 Reflectance and UPS studies of band structures and final state interactions of low-spin pyrites. S.Suga, M.Taniguchi, S.Shin, M.Seki, S.Shibuya (Synchrotron Radiation Lab., Univ. of Tokyo, Tokyo, Japan), K.Sato, T.Yamaguchi.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.353-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reflectance spectra of FeS_2 and NiS_2 have been measured with synchrotron radiation from 4 to 30 eV. The intensity decrease of the p(valence)$\rightarrow$p*+dγ

(conduction band) excitation from FeS_2 to NiS_2 is a characteristic feature of the low-spin configuration of the 3d electrons in pyrites. Photoelectron partial yield spectrum of FeS_2 has shown conspicuous multiplet structures in the region of the 3p core ($M_{2,3}$) excitation, which are quantitatively analyzed by a newly developed theory based on a localized model. The reduction factors κ_F and κ_G of the Coulomb and exchange interactions between the core p hole and the d electron are evaluated as 0.5 and 0.4, in agreement with the large covalency and itinerant nature of the d electrons in pyrites. (6 refs.)

72831 Optical determination of exciton sizes in semiconductors. S.M.Kelso (Xerox Palo Alto Res. Center, Palo Alto, CA, USA), D.E.Aspnes, C.G.Olson, D.W.Lynch.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.362-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors have studied the gradual disappearance of Ga3d core-exciton-related features in energy derivative reflectance spectra of GaAs crystals ion-implanted to increasing fluences. The data yield radii $r_L=23$ Å and $r_X=28$ Å for the L and X excitons. In addition, a lineshape fit for unimplanted GaAs yields core exciton binding energies $E_L=0.172$ eV and $E_X=0.129$ eV. These radii and binding energies are not related through an effective mass approximation description of the core exciton. (6 refs.)

72832 Strong electron-phonon interaction effects in modulated transient reflectance spectra of $Ga_{50}In_{50}P$. S.Sugai, J.H.Harris, A.V.Nurmikko (Div. of Engng., Brown Univ., Providence, RI, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.368-70 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Time-resolved modulated reflection spectrum near the fundamental edge of MBE-grown direct-gap $Ga_xIn_{1-x}P$ ($x=0.5$) has been studied by using sensitive picosecond excite-probe methods. The spectrum at 77K shows considerable structure in comparison with steady-state photoluminescence data. In particular, a strong optical phonon coupling effect has been observed in the transient spectra, suggestive of impurity intermediated bound polaron behavior. (11 refs.)

72833 Reflectance spectra and dielectric functions for Ag in the region of interband transitions. G.Leveque (Dept. of Phys., Iowa State Univ., Ames, IA, USA), C.G.Olson, D.W.Lynch.
Phys. Rev. B (USA), vol.27, no.8, p.4654-60 (15 April 1983).
New measurements have been made of the reflectances of single crystals of Ag and of Ag films in the (3.5-30)-eV range. The data were analyzed with the Kramers-Kronig method and the resultant dielectric functions were compared with those in the literature and with recent applications. The authors find all structures previously seen, and a new weak peak at 11.5 eV. Their magnitudes for ϵ_2 are in considerably better agreement with those of the calculated spectra than are those in the literature. Second-derivative spectra of the absorption coefficient have been calculated and compared with previously measured thermotransmission spectra, showing the latter to arise primarily by temperature-dependent broadening. (21 refs.)

72834 Study of the $[Co(CS_3)_3]^{3-}$ anion by UV-visible spectroscopy. J.N.Pons, J.Roger, M.Stern (Lab. de Chimie II, Univ. Pierre et Marie Curie, Paris, France).
Rev. Chim. Miner. (France), vol.20, no.1, p.118-22 (1983). In French.
Solution spectra of anion $[Co(CS_3)_3]^{3-}$ containing compounds do not show the predictable number of bands, and their shape depends on the nature of the solvent. With solids, especially $[(CH_3)_4N]_3[Co(CS_3)_3]$, the spectra are well defined, give access to the Racah parameters and locate the CS_3 ligand in a spectrochemical series among the sulfur ligands with the strongest field; its nephelauxetic effect however, although important, is weaker. (11 refs.)

72835 Metastable deexcitation spectroscopy and ultraviolet photoemission spectroscopy on electropolymerised polyacrylonitrile layer. C.Reynaud (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France), C.Boiziau, G.Lecayon, C.Le Gressus.
Scanning Electron Microsc. (USA), pt.3, p.961-6 (1982).
Studies polyacrylonitrile (PAN) which has interesting properties because of the presence of the polar nitril group. Heat treatment at 200°C produces a reticulation of the layer. This important structural transformation influences the electrical conduction as well as electronic spectra of the layer. The PAN layer behaves as a conductor above 100°C but undergoes sample charging phenomena below. The electrical properties are compatible with the phonon assisted hopping model. The spectra recorded for untreated and reticulated samples are in good agreement with previous molecular orbital calculations. This suggests that surface acrylonitrile molecules are weakly perturbed. (13 refs.)

Spectroscopy of molecular crystals. A bibliography for 1980 ..See Entry 69810

UV-excited resonance Raman spectra of methyl orange and its complex with cetyltrimethylammonium bromide .... See Entry 70888

Optical absorption spectrum of Pr^{3+} in aprotic $POCl_3$:$SnCl_4$ laser liquid ....See Entry 71115

Absorption edge of liquid crystal TBBA and the effect of an electric field on the spectra ....See Entry 71876

Network structure of sodium and potassium borosilicate glass systems ....See Entry 71890

Temperature dependence of accumulation efficiency and annihilation kinetics of primary Frenkel defects in KCl and KCl-I crystals in the temperature range 15-80K ....See Entry 71958

Optical and electrical properties of yttria stabilized zirconia (YSZ) crystals ....See Entry 72154

Theoretical and experimental aspects of the nonlinear spectroscopy of biexcitons in CuCl ....See Entry 72320

Non-equilibrium exciton phase in the high density regime of a direct-gap semiconductor ....See Entry 72321

Theoretical and experimental studies of the transition from the exciton to the plasma phase ....See Entry 72325

The Brewster effect in exciton reflectance spectra ....See Entry 72327

Determination of additional boundary conditions in CuCl [excitonic polaritons] ....See Entry 72329

Microstructure and electro-optical properties of evaporated indium-oxide films ....See Entry 72522

Optical constants of fused silica and sapphire from 0.3 to 25 μm ....See Entry 72744

Optical constants of pure and heavily doped silicon and germanium: electronic interband transitions ....See Entry 72754

Surface transition regions and visible-near UV optical properties of some semiconductors ....See Entry 72755

Optical properties of KDP and DKDP crystals grown at high rates ....See Entry 72759

Thermoreflectance spectra of [1,6-di (*N*-carbazolyl)-2,4-hexadiyne] (DCHD) polymer single crystal ....See Entry 72776

Thermoreflectance test of W, Mo, and paramagnetic Cr band structures ....See Entry 72777

Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect ....See Entry 72882

Blue sputtered iridium oxide films (blue SIROFs) ....See Entry 72988

The relationship of oxide film thickness and composition on titanium to the absorption coefficient on laser irradiation in an oxidizing atmosphere ....See Entry 73255

In situ analysis of passive and transpassive films on nickel by modulated UV-visible reflection spectroscopy ....See Entry 73282

Spectroscopic and electrochemical studies on ruthenium(II) complexes containing diazadiimine ligands ....See Entry 73383

78.45 STIMULATED EMISSION

(see also 42.65C in nonlinear optics)

72836 Control of carrier concentration by stimulated emission in highly excited direct gap semiconductors. V.D.Egorov, G.O.Muller, H.H.Weber (Zentralinst. für Elektronenphys., Akad. der Wissenschaften, Berlin, Germany), M.A.Jacobson, A.F.Dite.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.342-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Stimulated recombination may result in orders of magnitude reductions of lifetime of photo-excited carriers depending on the length over which optical amplification of (spontaneous) emission can occur. This effect has been verified in the excitation spot dependence of photoconductivity in CdS, in agreement with model calculations. (8 refs.)

Spectroscopy of molecular crystals. A bibliography for 1980 ..See Entry 69810

On coherence in spontaneous emission ....See Entry 71097

Stimulated emission from shallow donors localized by a strong magnetic field ....See Entry 71126

78.50 IMPURITY AND DEFECT ABSORPTION IN SOLIDS

72837 The F centre near a charged dislocation. J.L.Marin-Flores, R.Rodriguez-Mijangos, C.Ruiz-Mejia (Escuela de Altos Estudios, Univ. de Sonora, Sonora, Mexico).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1489-97 (April 1983).
The effect of the electric field due to a charged dislocation on the F Centre absorption spectrum is studied by the method of moments for an NaCl crystal. The elastic interaction of the centre with the dislocation strain field is also considered. The authors have calculated for these perturbations the fractional change in the peak height of the F band. Calculations suggest that this quantity can be measured experimentally and also that the effect of the electric field of a charged dislocation on the F centre spectrum is stronger than that of an F centre in a uniform field of the same strength. (29 refs.)

72838 Effect of aluminum content on infrared characteristics of BaF_2/ThF_4-containing glasses. B.Bendow, P.K.Banerjee, M.G.Drexhage, O.H.El-Bayoumi (Solid State Sci. Div., Rome Air Dev. Center, Hanscom AFB, MA, USA), S.S.Mitra, C.T.Moynihan, D.Gavin, G.Fonteneau, J.Lucas, M.Poulain.
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C64-6 (April 1983).
The incorporation of large amounts of aluminum substantially alters the IR characteristics of BaF_2/ThF_4-based glasses. In particular, a distinct peak associated with aluminum is observed in the fundamental reflectivity spectrum at ≈ 625 cm^{-1}, with a concomitant shift of the IR absorption edge to higher frequencies. Although beneficial for glass formation, the addition of aluminum has a deleterious effect on the IR transparency range of heavy-metal fluoride glasses. (15 refs.)

72839 New absorption band in the near IR assigned to a bound triplet state of the *F′* in NaI. G.Baldacchini, G.P.Gallerano (ENEA, Frascati, Italy), U.M.Grassano, F.Luty.
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.15, p.495-8 (9 April 1983).
The $F \rightarrow F'$ optical conversion in NaI is reduced by an external magnetic field, but not completely suppressed. In order to explain such unexpected result both a spin mixing in the optical cycle of the *F*-centre and the existence of a bound triplet state of the *F′*-centre have been considered. Absorption measurements have disclosed a new band at 1.4 eV whose properties are those expected in a transition from a triplet state. Moreover, its absorption intensity is in complete agreement with that calculated from the incomplete quenching of the $F \rightarrow F'$ conversion in a magnetic field. (8 refs.)

72840 A new conversion coefficient for oxygen content. Determination in Si by IR absorption. T.Iizuka, T.Arai, T.Nozaki, M.Tajima, N.Inoue, M.Watanabe, S.-I.Takasu.
Oyo Buturi (Japan), vol.51, no.11, p.1269-70 (Nov. 1982). In Japanese. [received: March 1983]
Dislocation free CZ silicon crystals of 2,1 and 0.5 mm size with polished surfaces were used. Oxygen was determined by the IR absorption in Si method using a zero oxygen reference. The results were plotted and a new conversion coefficient calculated after statistical analysis of the results. (6 refs.) *M.O.*

72841 Infrared absorption due to pair modes of the NO_2^- ions doped in KI single crystals. S.S.Khatri, A.L.Verma (Dept. of Phys., North-Eastern Hill Univ., Shillong, India).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.191-3 (25 April 1983).
Several extra bands in the vicinity of the antisymmetric stretching vibration of the NO_2^- ion doped in KI single crystals containing $\approx 10^{19}$ NO_2^- ions per cm^3 have been observed in high resolution infrared studies at 1.7K. These extra features are believed to arise from interactions between the induced dipole moments during ν_3 vibrations of the nearby nitrite ion pairs. (6 refs.)

72842 Spectroscopic studies of 450°C thermal donors in silicon. B.Pajot (Groupe de Phys. des Solides de l'Ecole Normale Superieure, Univ. Paris VII, Paris, France), H.Compain, J.Lerouille, B.Clerjaud.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.110-12 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Spectroscopic experiments (EPR and IR) on the 450°C thermal donors (TD) in oxygen rich silicon confirm that they are double donors with an effective mass character and a ladder of ionization energies. Nine distinct centres are identified. The experimental results can be explained qualitatively by the double donor character of a Si+O interstitial molecule which can form donor complexes first with interstitial oxygen and then with increasingly bigger neutral Si.O complexes. (10 refs.)

Spectroscopy of molecular crystals. A bibliography for 1980 ..See Entry 69810

***F*-centers: advanced laboratory experiments as a 'research project'** ....See Entry 69820

Optical constants of pure and heavily doped silicon and germanium: electronic interband transitions ....See Entry 72754

Recent progress in characterisation techniques. Development and standardisation of new techniques ....See Entry 72856

78.55 PHOTOLUMINESCENCE

72843 Effect of spin polarization, spin reorientation, and spin-lattice relaxation on the luminescence emitted by alkali-halide crystals at very low temperatures. G.Liid'ya (Phys. Inst., Acad. of Sci., Estonian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.11-14 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.429-32 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
The spin polarization of electron and hole trapping centers in alkali-halide crystals in a magnetic field can be investigated by examining the luminescence emitted when the electron centers recombine with hole centers. The quenching of recombinational tunnel luminescence of alkali-halide crystals (AHC) in a magnetic field, has been used as a method for the optical detection of EPR in dye centers. In this work, the authors consider photostimulated luminescence emitted after the excitation or ionization of electron centers by light. The hole centers will be taken to be V_k centers (self-localized holes) produced by X-rays at $T \approx 100K$. (16 refs.)

72844 Optical alignment in semiconductors. M.I.D'yakonov, I.A.Merkulov, V.I.Perel (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.3, p.60-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.3, p.482-6 (1982). [received: April 1983] (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
A brief review is given of effects occurring during the optical alignment of carrier spins in a semiconductor. Examples are given of the application of the optical alignment method to the investigation of the band structure of semiconducting materials, relaxation processes, and the interaction between electrons and the nuclear spin system in the lattice of a semiconductor. (16 refs.)

72845 Effects in the optical and electrical properties of CdS crystals from the accumulation of structural defects under laser irradiation. M.S.Brodin, N.A.Davydova, I.Yu.Shablii (Phys. Inst., Acad. of Sci., Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.25-30 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1037-43 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
Measurements have been made on the recombination spectra of CdS crystals previously exposed to ruby-laser pulses, and some electrical characteristics have also been measured, which has shown that structural defects mainly of donor type are produced, whose concentration increases with the pulse power and with the number of pulses. (13 refs.)

72846 Dependence of the gap on hydrogen content in a-Si:H. Chen Zhiming, Chen Tingjie, Kong Guanglin, Lin Lanying (Inst. of Semiconductors, Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.180-7 (Jan.-March 1983). [received: May 1983]
The optical gaps and the photoluminescence spectra of a-Si:H films prepared under different deposition conditions and their changes in annealing are measured. The results, combining the measurements of the infrared absorption spectra, show that both the pseudogap between the two band tails and the mobility gap of a-SiH broaden as the hydrogen content increases. Dehydrogenation makes the pseudogap and the mobility gap narrow, and increases dangling bonds, in a random network, which are responsible for the deep donor state at 1.20 eV below the conduction band tail and the corresponding defect photoluminescence. (12 refs.)

72847 Steady-state delayed fluorescence signals in Ronchi ruling experiments: theory of coherence effects. V.M.Kenkre, A.Fort, V.Ern (Lab. de Spectroscopie et d'Optique du Corps Solide, Univ. Louis Pasteur, Strasbourg, France).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.658-63 (29 April 1983).
Effects of coherence in triplet exciton transport are analyzed in the context of measurements of steady-state delayed fluorescence signals from molecular crystals excited through Ronchi rulings. (19 refs.)

72848 Special features of photoluminescence of GaAs films produced by molecular-beam epitaxy. V.I.Vovnenko, V.S.Ershov, N.S.Zayats, D.V.Korbutyak, E.G.Lashkevich, K.Lukat, Yu.G.Sadof'ev.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.11-19 (1982). In Russian.
The photoluminescence at 77K and 4.2K of GaAs films produced by molecular beam epitaxy is studied. The basic uncontrolled impurities in the films studied are found to be Mn, Ge, Si, C and Cr and the basic sources of pollution of the molecular beam epitaxy films are shown to be the stainless steel used to manufacture a number of items of production equipment and also gallium. When metallic As is used as the arsenic source, the films produced are purer and more perfect in composition than the films grown from polycrystalline gallium arsenide. The results of investigations into the phonon repetitions of the band with $h\nu_m = 1.404$ eV, its halfwidth and the Franck-Condon shift for different molecular beam epitaxy films indicate the presence of an extremely high degree of electron-phonon interaction for the corresponding Mn-centre. These results may also be used to draw conclusions about the degree of perfection of the films produced. (18 refs.) *L.M.H.*

72849 An electrodynamic theory of the nonadiabatic effects in rate processes for molecules adsorbed on metals. H.Metiu (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
Isr. J. Chem. (Israel), vol.22, no.4, p.329-38 (1982).
The author presents a theory which computes the role of the electronic excitations in a metal substrate in dynamic processes involving adsorbed molecules. He uses a model in which the molecular skeleton has effective charges whose magnitude and position varies when the nuclei of the molecule move. These moving charges couple to the electrons in the metal and excite them; as a result the molecule loses energy. The rate of such energy loss affects the vibrational line-width and the fluorescence lifetime of the molecule, the van der Waals interaction between adsorbed molecules and the motion of the molecule at the surface. He shows how these effects can be discussed in a unified way in terms of an electromagnetic theory. He emphasizes that for obtaining reasonable numerical results one must replace phenomenological Maxwell equations with a microscopic theory that takes into account the non-locality of the electron response to moving charges and the continuous nature of the interface. (42 refs.)

72850 Photoluminescence of iron-doped $KMgF_3$. A.Poirier, D.Walsh (Rutherford Phys. Building, McGill Univ., Montreal, Quebec, Canada).
J. Phys. C (GB), vol.16, no.13, p.2619-24 (10 May 1983).
Uniaxial stress applied to $KMgF_3$:Fe samples reveals that the ground state of the ion, which emits photoluminescence peaks in the 14000 cm^{-1} region at low temperature (2K), is a singlet orbital state. X-ray irradiation and heat treatment in O_2 and H_2 atmospheres together with high-temperature spectra (30K) of the $KMgF_3$:Fe samples show that the most probable ion is Fe^{3+}, the observed transitions being $^4T_1 \rightarrow {}^6A_1$. (24 refs.)

72851 Luminescence of Eu^{3+} and Tb^{3+} ions adsorbed on hydrated layer-lattice silicate surfaces. F.Bergaya, H.van Damme (Centre de Recherche sur les Solides a Organisation Cristalline Imparfaite, CNRS, Orleans, France).
J. Chem. Soc. Faraday Trans. II (GB), vol.79, pt.4, p.505-18 (April 1983).
The luminescence of Eu^{3+} and Tb^{3+} ions which have been cation exchanged on montmorillonite and hectorite clays has been monitored as a function of the amount of water co-adsorbed on the clay. The luminescence intensity of the montmorillonite samples was negligible, probably due to energy transfer to the Fe^{3+} ions of the montmorillonite lattice. With hectorite, the luminescence intensity displayed complex behaviour with a dramatic increase for some hydration states, which was qualitatively rationalised in terms of the rare-earth-clay interactions on the one hand and the rare-earth-water interactions on the other. (37 refs.)

72852 Low temperature photoluminescence of lightly Si-doped and undoped MBE GaAs. F.Briones, D.M.Collins (Solid State Lab., Hewlett-Packard Labs., Palo Alto, CA, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.847-66 (July 1982). [received: Nov. 1982]
A semiquantitative low temperature photoluminescence technique has been used to estimate the residual carbon concentration in MBE GaAs to be $\sim 2 \times 10^{14}$ cm^{-3}. This value agrees well with the total compensating acceptor concentration calculated from electrical measurements and thus confirms that carbon is the dominant residual acceptor in MBE GaAs. In high purity MBE GaAs films grown at substrate temperatures between 545°C and 625°C a band of at least nine luminescence peaks is observed in the 1.471 eV to 1.491 eV spectral region. These peaks can be correlated with the most prominent 'defect-induced' bound excitation peaks in the 1.504 eV to 1.511 eV spectral region and anir transition energies follow the empirical relation. (16 refs.)

72853 Optical spectra of pairs of Ni^{2+} ions in MgO. G.A.Grinvald, N.A.Mironova.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.22-7 (1983). In Russian.
Fine structure of the $^3A_{2g} \rightleftarrows {}^3T_{2g}$ band of Ni^{2+} (5 at.%) in MgO has been studied. Apart from $^3A_{2g} \rightleftarrows E(^3T_{2g})$ zero-phonon line of the isolated ion, three lines are associated with the nickel pair (probably nearest neighbour), whereas one line is connected with another Ni^{2+} cluster. The positions of two components of both the $E(^3T_{2g})$; $^3A_{2g}$ and the $^3A_{2g}$; $^3A_{2g}$ manifolds of the Ni^{2+} pair are determined. Temperature dependence of relative intensities of luminescence from isolated ions, their pairs and 'clusters' can be explained by energy transfer between these centres. (15 refs.)

72854 Luminescence of Ni^{+2} in $Ni_cMg_{1-c}O$ single crystals. G.A.Grinvald, N.A.Mironova.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.28-34 (1983). In Russian.
The fine structure of the $^3A_{2g} \rightleftarrows {}^3T_{2g}$ band of Ni^{2+} in $Ni_cMg_{1-c}O$ single crystals, where c varies from 0.01 to 1.00, has been studied. It is found that for $c \geq 0.05$ the best part of the luminescence intensity is associated with Ni^{2+} centres, which form traps of electron excitation. The luminescence intensities of such Ni^{2+} centres vary like $e^{\Delta/kT}$, where Δ is the depth of the trap. (9 refs.)

72855 Fluorescence spectra and energy migration behavior of *o*-terphenyl single crystal and glassy solid. T.Onaka-Ito, Y.Maruyama (Dept. of Chem., Ochanomizu Univ., Tokyo, Japan).
Mol. Cryst. & Liq. Cryst. (GB), vol.91, no.3-4, p.187-96 (1983).
Fluorescence spectra of very pure *o*-terphenyl single crystal and glassy solid were observed and their origins were assigned to intramolecular excimer states. For the anthracene-doped *o*-terphenyl solids, the concentration dependence and/or time evolution behavior of the fluorescence spectra showed that the energy transfer really occurs even in the glassy solid and its rate is of nearly the same order of magnitude as in the crystal. (9 refs.)

72856 Recent progress in characterisation techniques. Development and standardisation of new techniques. M.Tajima (Electrotech. Lab., Ibaraki, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1255-61 (Nov. 1982). In Japanese. [received: March 1983]
IR absorption is central to characterisation methods. Two photoluminescence methods developed by the author are described. Using them the quantitative measurement of dopant levels in silicon crystals is possible. Further development of the techniques are described. The importance of standardisation of methods is emphasised and recently published methods are reviewed. (31 refs.) *M.O.*

72857 Luminescence as an indicator of spatial distribution of Mn^{2+} ions in TGS crystals. J.Mroz, S.Gebela (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.403-9 (1982).
Presents evidence of the spatial distribution of luminescence in TGS crystals doped with manganese. The observations were carried out in the XZ-plane. A strongly polarized blue luminescence in the growth pyramid (001) as well as a green luminescence in the (203) pyramid without any oriented centres were detected. Spectral distributions and luminescence excitation spectra are shown. In these spectra some differentiation in the charge transition spectral region

and an appearance of bands connected with d-d transitions are stated. (11 refs.)

72858 Radiative unstabilities in some triple electronic colour centre systems in ionic crystals. A.A.Berezin (Dept. of Engng. Phys., McMaster Univ., Hamilton, Ontario, Canada).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.266-8 (2 May 1983).
The principal unstability of some polyvalent triple impurity systems against the possibility of radiative tunnel transitions (RTTs) is discussed. As an example, a three-centre system of neutral, negatively charged and positively charged F-, F′-and α-colour centres in an alkali halide crystal is considered. It the distance between F- and F′-centres is much smaller than the F′-α distance then, along with a very slow RTT process, $F'+\alpha \rightarrow 2F$, a much faster RTT process $F'(b)+F(1) \rightarrow F(h)+F'(1)$ is also possible. Here, h and 1 denote the relatively higher and lower energy position of the trapping level for an extra electron at two F-sites caused by their different distances from the charged α-centre. This type of radiative unstabilities could be relatively significant in areas of defect clustering. (10 refs.)

72859 Subnanosecond total-light decay and spectra in α-Si:H. B.A.Wilson, P.Hu, J.P.Harbison, T.M.Jedju (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1490-3 (9 May 1983).
With use of an ultrafast Ge photodiode and a high-power picosecond laser system, the fastest radiative processes in plasma-deposited *a*-Si:H have been resolved. Spectrally integrated measurements on a 250-ps time scale provide a simple picture that for the first time isolates single rates in the recombination dynamics, permitting quantitative physical modeling. Spectral shifts are observed on time scales faster than the radiative decay, providing clear evidence of slow relaxation processes. (14 refs.)

72860 Electronic properties of heavily-doped n-type silicon. A.Selloni, S.T.Pantelides (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.78-80 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Heavy doping has been known to reduce the energy gap of semiconductors, affecting the characteristics of many devices. In the case of Si, theoretical work has so far focused on calculating the reduced gaps. Despite the extensive calculations, however, no meaningful comparison of theory with experiment has been achieved because there exist major discrepancies in the values of the gap extracted from different experiments. In this paper, the authors point out that these discrepancies arose because the data were fitted by assuming simple models for different properties and report calculations of the photoluminescence spectra of n-type Si for various impurity concentrations. They find that intervalley scattering, previously considered negligible, is essential in order to reproduce the major experimental features and trends. (14 refs.)

72861 Disorder and N-N transfer mechanism in nitrogen-bound exciton luminescence of GaP_xAs_{1-x}:N systems. H.Mariette, V.Thierry-Meig, J.Chevallier (Lab. de Phys. des Solides, CNRS, Meudon, France), P.Leroux Hugon.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.102-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Temperature and nitrogen concentration dependences of the luminescence and excitonic spectra in GaP_xAs_{1-x}:N systems give evidence for a hopping transfer mechanism of excitons between states of a disorder-broadened band. CPA calculations are also reported. (12 refs.)

72862 Momentum-space condensation of probe-injected biexcitons into a strongly pumped biexciton state in CuCl. N.Peyghambarian, L.L.Chase (Indiana Univ., Bloomington, IN, USA), A.Mysyrowicz.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.299-300 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Two sets of new results are presented which confirm the occurrence of a Bose-Einstein condensation of biexcitons in CuCl. First, luminescence spectra recorded under well controlled conditions yield the distribution function of the particles, which takes the form of a strongly degenerate Bose-Einstein distribution under increasing excitation, with μ up to 0. Second, probe particles injected into the system in the presence of the presumed condensate are observed to coalesce into it. (4 refs.)

72863 The role of iodine for the luminescence of highly excited AgBr. Th.Kleinefeld, H.Stolz, W.von der Osten (Fachbereich Naturwissenschaften I, Experimentalphys., Univ.-Gesamthochschule, Paderborn, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.306-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Using time-resolving techniques, the recombination luminescence observed under high power excitation at low temperature is studied in nominally pure AgBr that systematically varies in iodine impurity content. Several new features in the luminescence spectrum are observed that are correlated with iodine concentration. On the basis of these results, including energy positions and lineshapes, the high excitation luminescence is consistently explained in terms of recombination of a biexciton bound to iodine. Intervalley exciton scattering by X-phonons known to be an important relaxation mechanism in AgBr has to be considered to fully account for the observed lineshapes. (9 refs.)

72864 Photoluminescence efficiencies and yields in disordered systems. T.M.Searle (Dept. of Phys., Univ. of Sheffield, Sheffield, England).
Solid State Commun. (USA), vol.46, no.4, p.291-3 (April 1983).
The photoluminescnece efficiency and yield of a simple system consisting of a single radiative centre surrounded by a random distribution of non-radiative centres are considered. It is shown that the ensemble averages for both these quantities are identical and given by a double integral. Upper and lower limits on this average are derived, and it is shown that the lower limit also provides a rapidly evaluated approximation to the exact average for most realistic transfer functions, which is accurate to within about 10%, over at least five orders of magnitude fall of efficiency. (7 refs.)

72865 Isotope shifts for the P, Q, R lines in indium-doped silicon. T.E.Schlesinger, R.J.Hauenstein, R.M.Feenstra, T.C.McGill (California Inst. of Technol., Pasadena, CA, USA).
Solid State Commun. (USA), vol.46, no.4, p.321-4 (April 1983).
The authors have measured the isotope shift of the P and R luminescence lines in Si doped with In and diffused with isotopically enriched Fe. They find no measurable shift in the R line. Similar experiments on the luminescence line attributed to an isolated Fe complex show no shift in the previously identified 'phonon replicas'. Theoretical calculations of defect phonon resonances near 9 meV for interstitial and substitutional Fe predict an isotope shift of 0.17 meV for ^{56}Fe and ^{54}Fe. This value is in disagreement with the observed lack of a shift. (12 refs.)

72866 Observation of the internal luminescence of $Cr^{2+}(3d^4)$ in GaAs under hydrostatic pressure. B.Deveaud, G.Picoli (CNET (LAB/ICM),,France). Lannion, Y.Zhou, G.Martinez.
Solid State Commun. (USA), vol.46, no.4, p.359-62 (April 1983).
Observation of the internal luminescence of $Cr^{2+}(3d^4)$ in GaAs under hydrostatic pressure is reported. The activation of this luminescence is correlated to the lifting of the degeneracy between the excited level of Cr^{2+} and the conduction band of the host material. The possible mechanisms giving rise to this luminescence are discussed. (15 refs.)

72867 Effect of electron-phonon interaction on the photoluminescence of single crystals of BiI_3. M.P.Lisitsa, F.V.Motsnyi (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1765-6 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3120-2 (Oct. 1982). [received: April 1983]
The photoluminescence spectra of single crystals of BiI_3 at T=4.2K contain an extremely wide asymmetric band λ=0.9 μ, whose half-width is 173 meV. This band is due to associated defects, which may contain impurity atoms of Ag, Pb, Ag+Pb, Cu, As and Sb. The authors clarify the nature of this band by comparing data on its half-width and its contour with the results of the Pekar-Krivoglaz theory (1953, 1956), which takes electron-phonon interaction into account. (9 refs.)

72868 Dependence of the properties of a nonequilibrium degenerate electron-hole plasma on the energy of the exciting photons in ZnTe crystals. M.S.Brodin, V.M.Bandura, I.I.Zheru, M.G.Matsko (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1774-5 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3133-6 (Oct. 1982). [received: April 1983]
The authors show for the first time that the luminescence bands of a nonequilibrium degenerate electron-hole plasma can be simply and unambiguously identified with the aid of a tunable laser. They have studied the features of the luminescence spectra of ZnTe single crystals under intense excitation by a tunable coumarin-30 dye laser having a pulsed power of 20 kW and a pulse length of 8 nsec. The measurements were made on a diffraction spectrograph having a dispersion 7.2 Å/mm with a stroboscopic recording technique. (6 refs.)

Spectroscopy of molecular crystals. A bibliography for 1980 ..See Entry 69810

Chemical short-range order and phase separation in Pr-Ga-Fe glasses ....See Entry 71896

Extremely rapid outdiffusion on *n*-type impurities in InP ....See Entry 72163

On the conduction band edge energy of ice ....See Entry 72303

The vibration-quenching of the exciton and the Huang-Rhys factor in the quasi one-dimensional antiferromagnet CMC ....See Entry 72310

Effect of the pumping intensity on the resonant secondary emission spectra of optically aligned hot excitons in ZnTe crystals ....See Entry 72314

Interaction of phonons with the electron-hole liquid ....See Entry 72323

Spin aligned exciton gas in uniaxially compressed Ge ....See Entry 72324

Influence of the anisotropy of the probabilities of optical transitions of holes on the drag current in semiconductors of *p*-Ge type ....See Entry 72423

Thermodynamic properties of equilibrium and non-equilibrium plasmas in GaP ....See Entry 72434

The e-h plasma in direct-gap GaAlAs under 3-D confinement ....See Entry 72435

The properties of ZnSe MIS structure ....See Entry 72509

Optical alignment of the bound electron-nuclear spin system of a semiconductor ....See Entry 72705

Effect of the field due to optically aligned electrons in a semiconductor on the polarization of nuclei in an inclined magnetic field ....See Entry 72707

Optical detection of EPR using the luminescence emitted by crystal defects ....See Entry 72714

Relaxation of electron-phonon system in optically excited quasi-1-D mixed valence crystal Wolffram's red salt ....See Entry 72787

The influence of the interface state on the properties of solar cell semiconductor electrodes ....See Entry 73434

78.60 OTHER LUMINESCENCE SPECTRA AND RADIATIVE RECOMBINATION

(for photoconduction and photovoltaic effects, see 72.40; for photoluminescence, see 78.55)

72869 Increase of the efficiency of emission of light by surface plasma oscillations in metal-barrier-metal-liquid crystal structures. E.M.Belenov, I.N.Kompanets, A.V.Parfenov, Yu.M.Popov, I.A.Poluektov, S.I.Sagitov, E.M.Soboleva, A.G.Sobolev, A.V.Uskov, V.G.Tsukanov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1496-7 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2306-7 (Nov. 1982). [received: May 1983]
An increase in the efficiency of light emission (by over an order of magnitude) was achieved for plasma oscillations in a thin silver film of a gold-aluminum oxide-silver (Au-Al_2O_3-Ag) structure by altering the permittivity of a nematic liquid crystal adjoining the silver film. (4 refs.)

78.60F Electroluminescence

72870 Electroluminescence in RF sputtered ZnS:TbF_3, Mn thin films. A.Mikami, K.Ando (Dept. of Electrical Engng., Osaka City Univ., Osaka, Japan).
Mem. Fac. Eng. Osaka City Univ. (Japan), vol.23, p.39-46 (Dec. 1982). [received: May 1983]
For the purpose of preparing electroluminescent (EL) devices with various color, ZnS:TbF_3, Mn thin films were formed by RF sputtering using a target which was a mixture of ZnS, TbF_3 and MnS powders. Dependence of electroluminescence spectrum of the EL device on the concentrations of TbF_3 and MnS in the target were investigated in detail. The spectrum usually consists of four emission bands in the visible-light region. First two bands around 490 and 545 nm are due to the Tb-F complex center, the third around 585 nm is due to the Mn single center, and the fourth around 710 nm is due to the Mn-F complex center. The intensity ratio between emissions originating in the Tb-F and the Mn centers can be easily controlled by adjusting the concentrations of $TbF_3$and MnS in the target, and the color of light emitted by the device varies from green to orange with increasing composition ratio of MnS

to TbF_3. The red emission around 710 nm with very weak intensity relative to others hardly affected the emission color of the EL device. (11 refs.)

72871 Hot-electron picture of light emission from tunnel junctions. J.R.Kirtley, T.N.Theis, J.C.Tsang, D.J.DiMaria (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4601-11 (15 April 1983).
Metal-insulator-metal tunnel junctions emit optical radiation when biased at voltages in the range 2-4 V. The authors argue that a complete picture of this radiation process includes hot electrons which excite surface electromagnetic resonances, which are in turn coupled to external radiation though surface roughness. This picture is supported by measurements of the temperature and second-metal-electrode thickness dependence of the emission intensities, and by light emission from surface plasmons excited by optical pumping and by charge injection. (28 refs.)

72872 Electroluminescence of GaAs single crystals at 300K. A.G.Bagirov, S.Yu.Bagirov, E.Yu.Salaev (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1397 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2166-7 (Dec. 1982). [received: May 1983]
The authors present the results of the first study of electroluminescence of GaS single crystals at 300K. Electroluminescence was excited by an alternating (sinusoidal) voltage. Experiments showed that GaS single crystals with InGa contacts emitted stronger electroluminescence than those with In contacts. A visual examination showed that electroluminescence was concentrated around the metal electrode and it appeared in the form of separate spots emitting different colors. (7 refs.)

Temperature dependence of interface recombination and radiative recombination in (Al, Ga)As heterostructures ......See Entry 72481

The properties of ZnSe MIS structure ......See Entry 72509

Luminescence of metal-tunnel-thin insulator-n-Si-p^+-Si systems ......See Entry 72513

78.60H Cathodoluminescence, ionoluminescence

72873 Spatial distribution of photons with a continuous spectrum emitted by sputtering products. S.F.Belykh, V.I.Veksler (Tashkent Lenin State Univ., Tashkent, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.163-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1389-94 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
An important parameter characterising the continuous optical spectrum emitted by sputtering products is the spatial intensity distribution, I(x), in the halo of the emission. The authors determine I(x) for a variety of transition and rare earth metals. Within the framework of the two-photon mechanism, they show that the difference in the shape of the I(x) curves for the two series of metals may be due to the fact that the two-photon transition probability should be higher for lanthanides. (18 refs.)

72874 Cathodoluminescence of anodically grown SiO_2 films. P.A.Pundur, E.A.Slotsenietse, Yu.A.Tarantov, Y.V.Bulavinov.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.50-3 (1983). In Russian.
The properties of thermally and anodically grown SiO_2 films have been studied by methods of cathodoluminescence and C-V characteristics. It is established that there are identical types of intrinsic defects in both the SiO_2 films though the concentration and distributions of the defects are not equal. The electrolyte has been used as a source of impurity defects in thin SiO_2 films. It is concluded that the anodic polarization in the electrolyte with a high electrical field changes the structure of thermally grown SiO_2 films approaching the structure of the anodic SiO_2 films. (8 refs.)

72875 A simple, high collection efficiency cathodoluminescence imaging technique: application to GaSb and CdTe. A.K.Chin (Bell Labs., Murray Hill, NJ, USA).
Scanning Electron Microsc. (USA), pt.3, p.1069-75 (1982).
Spatially resolved cathodoluminescence (CL) imaging is a powerful method for evaluating the quality of luminescent materials. However, sophisticated collection optics, which are not commercially available, are generally required for CL evaluation of materials with low luminescence efficiency. In this paper, a simple, high collection efficiency CL technique is used to reveal defects in CdTe and growth striations in GaSb. A solid state photodiode is used within the sample chamber of the scanning electron microscope to detect the CL emission. Features observed in the CL images of both semiconductors are correlated with those revealed by a defect etchant. For GaSb, the carrier concentration is found to be directly proportional to the CL intensity. For the samples used in this study, the variations in CL intensity and thus the carrier concentration within the growth striations are estimated to be ~20%. (9 refs.)

Extremely rapid outdiffusion on *n*-type impurities in InP ......See Entry 72163

78.60K Thermoluminescence

72876 Thermoluminescence of Al_2O_3 layers formed by anodic oxidation in oxalic acid. R.Dragon, S.Marzec (Phys. Lab., Higher School of Engng., Opole, Poland).
Opt. Appl. (Poland), vol.12, no.3-4, p.433-43 (1982).
Thermoluminescence (TL) of Al_2O_3 layers obtained by electrolytic oxidation of aluminium in aqueous solution of oxalic acid has been investigated. It has been found that the Al_2O_3 layers show both the natural (without excitation) as well as the UV-excited thermoluminescence. By applying the method proposed by Alencev-Fok (1972) and Antonov-Romanovskii (1966) it has been shown that in the case of the layers formed at DC voltage the TL-curve consists of 5 and 3 elementary glow-peaks depending on whether thermoluminescence is natural or stimulated. For the layers formed at AC voltage 2 or 6 elementary glow-peaks were observed, respectively. For all the observed elementary glow-peaks the activation energy of the electron traps has been calculated. (16 refs.)

72877 Regenerated thermoluminescence. S.Charalambous, F.Hasan (Nuclear Phys. Dept., Univ. of Thessaloniki, Thessaloniki, Greece).
Phys. Lett. A (Netherlands), vol.95A, no.5, p.259-62 (2 May 1983).
A regenerated, non-radiation induced TL was observed. Results versus dose, storage time, storage temperature, maximum first heating, are presented. For the phenomenon a theoretical model is given, based on the formation of a peculiar composite defect from migrated defects and trapped electrons. (4 refs.)

Hole-induced exoelectronic emission ......See Entry 72972

78.65 OPTICAL PROPERTIES OF THIN FILMS

72878 Elementary surface excitations in insulators and metals. Methods of spectral examination. G.N.Zhizhin, E.A.Vinogradov, M.A.Moskaleva, V.A.Yakovlev (Spectroscopy Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.76-81 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1097-103 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
A survey is presented of methods of examining surface and thin films using surface-excitation spectroscopy. Surface-polariton spectroscopy for insulators enables one to examine thin films of metals and insulators on crystals. The thermally stimulated emission of surface polaritons has been used to examine thin crystalline films and single crystals. Surface-electromagnetic wave spectroscopy is a very sensitive method of examining the surface state of a metal mirror and also for detecting roughness, oxide layers, and contaminants. (28 refs.)

72879 The role of rate of deposition and substrate temperature on the structure and loss of zinc sulphide and magnesium fluoride films. A.A.J.Al-Douri, O.S.Heavens (Phys. Dept., Univ. of York, Heslington, England).
J. Phys. D (GB), vol.16, no.5, p.927-35 (14 May 1983).
By the use of an integrating sphere, the scattering losses in films of magnesium fluoride and zinc sulphide have been measured as functions of deposition rate and of substrate temperature. It is established that an optimum deposition rate exists and that scattering losses increase with increasing substrate temperature. Electron micrographs of the films reveal structural features which generally correlate with scattering observations. Over a wide range of deposition rates, the scattering results agree with those using other methods. There is a suggestion that for zinc sulphide part of the losses at very high deposition rates arise through absorption rather than through scattering. (6 refs.)

72880 Angular scan spectrum of a surface plasma excitation on a Schottky diode. J.Derov, Y.Y.Teng, A.S.Karakashian (Dept. of Phys. & Appl. Phys., Univ. of Lowell, Lowell, MA, USA).
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.197-200 (25 April 1983).
The reflectivity and quantum efficiency response functions of a Schottky-barrier diode are measured in an angular scan attenuated total reflection experiment. The excitation of the surface plasma resonance is observed in both of these response functions. Improvements in the quantum efficiency of the diodes over the normal incidence case by factors of from 1.5 to 11.5 are obtained when the surface plasma resonance is excited. (5 refs.)

72881 Optical properties of epitaxial $PbS_{1-x}Se_x$ films. A.A.Sinyatynskii, A.P.Shotov (P.N. Levedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1413-14 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2187-90 (Dec. 1982). [received: May 1983]
The authors study the electrical and optical properties of $PbS_{1-x}Se_x$ epitaxial films near the fundamental absorption edge. They report measurements on the optical transmission, refractive index, carrier density and carrier mobility. (8 refs.)

72882 Changes in the absorption at energies smaller than the optical band gap of hydrogenated amorphous silicon in the Staebler-Wronski effect. V.S.Vavilov, A.G.Kazanskii, E.P.Milichevich (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.12, p.1417-18 (Dec. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.12, p.2192-4 (Dec. 1982). [received: May 1983]
The effects exhibited by hydrogenated amorphous silicon (α-Si:H) include the reversible changes in the dark conductivity σ_d and in the photoconductivity σ_{ph}, observed after illumination of a sample with light of photon energy $h\nu=1.6$-2.0 eV: this is known as the Staebler-Wronski effect. The authors investigate the influence of prolonged illumination of α-Si:H on the form of the $\alpha(h\nu)$ absorption spectra at energies lower than the band gap ($h\nu<1.8$ eV). (13 refs.)

Calculation of the reflectivity of multilayer dielectric TiO_2-SiO_2 mirrors at 1.06 microns using the diagram technique ......See Entry 71217

Column structure of dielectric evaporated layers and some of their properties ......See Entry 72260

The effects of incorporating fluorine in amorphous germanium-silicon alloy films ......See Entry 72261

Microstructure and electro-optical properties of evaporated indium-oxide films ......See Entry 72522

Variations of trap states and dangling bonds in CVD Si_3N_4 layer on Si substrate by NH_3/SiH_4 ratio ......See Entry 72527

Anomalous infrared absorption in granular superconductors ......See Entry 72547

Photo-induced changes of optical properties in noncrystalline As-S system films ......See Entry 72745

Optical absorption in single-crystal metastable $(GaAs)_{1-x}(Ge_2)_x$ alloys; evidence for a zinc-blende-diamond order-disorder transition ......See Entry 72752

Electron microscopic and ellipsometric studies on oxidized aluminium layers ......See Entry 72761

Electro-optic effects of (Pb, La)(Zr, Ti)O_3 thin films prepared by RF planar magnetron sputtering ......See Entry 72770

An infrared absorption study of LTCVD silicon dioxide ......See Entry 72786

Strong electron-phonon interaction effects in modulated transient reflectance spectra of $Ga_{.50}In_{.50}P$ ......See Entry 72832

Reflectance spectra and dielectric functions for Ag in the region of interband transitions ......See Entry 72833

Dependence of the gap on hydrogen content in a-Si:H ......See Entry 72846

Special features of photoluminescence of GaAs films produced by molecular-beam epitaxy ......See Entry 72848

Low temperature photoluminescence of lightly Si-doped and undoped MBE GaAs ......See Entry 72852

Subnanosecond total-light decay and spectra in α-Si:H ......See Entry 72859

Increase of the efficiency of emission of light by surface plasma oscillations in metal-barrier-metal-liquid crystal structures ......See Entry 72869

Electroluminescence in RF sputtered ZnS:TbF_3, Mn thin films ......See Entry 72870

Cathodoluminescence of anodically grown SiO_2 films ......See Entry 72874

Photoemission study of oxygen adsorbed on coldly deposited silver films ......See Entry 72961

Blue sputtered iridium oxide films (blue SIROFs) ......See Entry 72988

Annealing effects in a-Si:H thin films prepared by glow discharge method ....See Entry 73002

The relationship of oxide film thickness and composition on titanium to the absorption coefficient on laser irradiation in an oxidizing atmosphere ....See Entry 73255

78.70 OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

78.70B Positron annihilation

(see also 71.65 Positron states)

72883 **Measurement of 3γ annihilation of positron using Ge(Li) detector.** Wu Gun-hung, Wang Yun-yu, Tang Hsiao-wei (Inst. of High Energy Phys., Acad. Sinica, Beijing, China).
Acta Phys. Sin. (China), vol.32, no.3, p.417-22 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
A method for measuring the positron 3γ annihilation with Ge(Li) detector is introduced, in which the relative yields of 3γ annihilation is measured by the counts of the 511 keV peak only. The authors call it the 'peak method', and compare it with the 'peak-valley method'. (7 refs.)

72884 **Determination of the ferromagnetic vacancy-formation enthalpy in α-iron by the positron method using the carbon-vacancy pair as a probe.** L.de Schepper (Materials Phys. Group, Limburgs Univ. Centrum, Diepenbeek, Belgium), D.Segers, G.Knuyt, L.Dorikens-Vanpraet, M.Dorikens, L.Stals, P.Moser.
Phys. Lett. A (Netherlands), vol.95A, no.2, p.121-3 (18 April 1983).
The 511 keV positron annnihilation lineshape was measured as a function of temperature between 600 and 1183K in extremely pure and carbon-doped (50 and 750 appm C) iron. Whereas in pure iron no trapping of positrons is observed below the Curie temperature (1043K), trapping in carbon-vacancy pairs is observed in this temperature range in the carbon-doped samples. This allowed the authors to determine the ferromagnetic vacancy-formation enthalpy as 2.0±0.2 eV. (16 refs.)

Electron and positron response to atomic defects in solids: A theoretical study of the monovacancy and divacancy in aluminum .... See Entry 72349

78.70D X-ray absorption and absorption edges

72885 **Large anisotropic vibrational correlations in *A*15 Nb_3Ge.** G.S.Cargill,III, R.F.Boehme, W.Weber (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. Lett. (USA), vol.50, no.18, p.1391-4 (2 May 1983).
Extended X-ray-absorption fine-structure measurements on Nb_3Ge at temperatures from 8 to 300K using the Nb *K* edge show large anisotropies in nearest-neighbor vibrational correlations arising from one-dimensional transition-metal chains in the A15 structure. A simple view of these vibrations involves combinations of optical phonons which cause chains of Nb atoms to vibrate, nearly undistorted within the BCC lattice of Ge atoms, uncorrelated with vibrations of adjacent, perpendicular Nb chains. (10 refs.)

72886 ***f*-count effects in X-ray-absorption spectra of the 3*d* levels in Ce and its intermetallic compounds.** J.C.Fuggle, F.U.Hillebrecht (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), J.-M.Esteva, R.C.Karnatak, O.Gunnarsson, K.Schonhammer.
Phys. Rev. B (USA), vol.27, no.8, p.4637-43 (15 April 1983).
The 3*d* X-ray-absorption spectra of Ce, $CeSn_3$, CeAu, CePd, Ce_3Pd_5, $CePd_3$, $CeNi_2$ and $CeNi_5$ have been studied. Results of theoretical calculations of the 3*d* absorption spectra are also reported. Comparison with theory shows that the observed spectra are compatible with photoemission-derived 4*f*-level widths, arising from hybridization with the conduction states, of 30-130 meV and *f* counts greater than 0.8, in all the compounds studies. The relative merits of X-ray-absorption spectroscopy as a tool for the study of Ce compounds are briefly discussed. (45 refs.)

72887 **Structural and electronic properties of Fe and TiFe from extended and near-edge X-ray-absorption structure.** N.Motta (Scuola Normale Superiore, Pisa, Italy), M.De Crescenzi, A.Balzarotti.
Phys. Rev. B (USA), vol.27, no.8, p.4712-21 (15 April 1983).
The extended X-ray-absorption fine structure of Fe and TiFe has been measured above the edges of Fe and Ti at 80 and 300K. In both materials the fifth and sixth coordination shells show clear evidence of multiple-scattering effects due to the intervening first- and second-shell atoms. The plane-wave approximation for the scattering is found to be inadequate and corrections for the wave curvature are made to the backscattering phase shifts of the first shell. The first peak of the radial distribution function of Fe and TiFe is decomposed into its constituents by means of the beat method. The local order of TiFe around both Ti and Fe atoms is good up to the sixth coordination shell. It is shown that the near-edge structure of both Ti and Fe *K* edges of TiFe reflects the local state density of *p*-like symmetry at the titanium site, in agreement with detailed partial-density-of-states calculations. (25 refs.)

72888 **X-ray spectra and electronic structure of titanium, zirconium and hafnium gallides.** Ya.I.Dutchak, I.D.Shcherba, B.N.Yatsyk.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.559-63 (April 1983). In Russian.
An X-ray spectral analysis is carried out for the electronic structure of titanium, zirconium and hafnium gallides. The same order of sequence is established for the electronic states of different symmetry which form the valence zone of transition metal gallides. A joint consideration of the calculated interatomic distances of crystal structures of the halides with results of X-ray spectral analysis allowed a conclusion on the nature of interatomic interaction in the investigated compounds to be made. (3 refs.)

Investigation of TiO_2-SiO_2 glasses by X-ray absorption spectroscopy ....See Entry 71891

Exchange banding of excited core states and its effects on core-level spectroscopies ....See Entry 72299

High-pressure and extended X-ray-absorption fine-structure study of Cr-rich Cr-Ge alloys ....See Entry 72606

78.70E X-ray emission threshold and fluorescence

72889 **Binding energy of electrons of surface atoms of oxidized 3d transition metals, obtained by the method of appearance-potential spectroscopy.** M.A.Vasil'ev, V.T.Cherepin, O.A.Yakubtsov (Inst. of Metal Phys., Acad. of Sci., Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.119-22 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1342-5 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors examined high-temperature oxidation of 3d transition metals in an atmosphere of pure oxygen using the method of spectroscopy of appearance potentials of soft X-ray emission (SAPSX) and Auger electron spectroscopy (AES), which yield information on the binding energy of electrons and on the composition of the surface layer around 1 nm thick. (16 refs.)

72890 **The surface chemical bonding investigation of CVD coated tool-steel.** A.Szasz, L.Kertesz, J.Kojnok (Inst. for Solid State Phys., Eotvos Univ., Budapest, Hungary), M.Kovats, S.Z.Csih.
Vacuum (GB), vol.33, no.1-2, p.43-7 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Investigates the special cutting tool-steel, coated with TiC and TiN compounds. The tools were tested in different states by soft X-ray emission spectroscopy (SXES) in the regions of the CK_α, NK_α, FeL_α and OK_α emission peaks of the compounds, and they were investigated at different depths of the coating layer. The emission lines of the steel holder and its surroundings appear at depths of more than 600 nm. Shifts of the OK_α peak and the fine structure changes in it show clearly the corrosion steps and states of the used tools, corresponding to the degree of use. The measurements prove clearly that heat treatment is a sensitive step in the technology of preparation of the CVD coated tool-steel. Exposure to oxygen during heat treatment decreases the life of the tool drastically. (11 refs.)

72891 **The changes of the electron states depending on the depth of surface layers of Al-based alloys.** L.Tolnai (Coll. of Transport & Telecommunication, Gyor, Hungary), L.Kertesz, A.Szasz, J.Kojnok.
Vacuum (GB), vol.33, no.1-2, p.59-61 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
The method of soft X-ray emission spectroscopy (SXES) offers the possibility to study the chemical bonding of the oxidization layer, and the complex oxide. In the authors' investigation the corrosion states of the pure aluminium and the oxide wear-resistant layer of an Al-based alloy was studied. The surface layer from 10 nm to 550 nm was investigated. The corrosion states of the pure Al showed the changes of bondings and a change in concentration depending on the penetration depth of the corrosion processes. The studies of the wear-resistant oxide layers contain the measurements of the components of the alloy too. The authors present the systematic changes of the chemical components. The researches show the complex oxide and carbide compounds characterizing the layers which have good tribological parameters. Their results point out the important features for the technology to create wear-resistant layers. (7 refs.)

72892 **Changes in AlMgSi surface layers at different temperatures.** L.Kertesz, A.Szasz, J.Kojnok (Inst. for Solid State Phys., Eotvos Univ., Budapest, Hungary), A.A.Katsnelson.
Vacuum (GB), vol.33, no.1-2, p.63-6 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
It is possible to determine temperature ranges caused by electron beams under high voltage conditions. Combining the radiation power of SXES equipment with DTA curves the authors were able to make conclusions concerning the temperature range during radiation time. Heat treatments under vacuum and continuous SXES measurements show a shift of the Fermi level and a change in the fine structure of the AlMgSi surface. (15 refs.)

72893 **The SXES study of the amorphous Ni-P compounds.** A.Szasz, L.Kertesz, J.Kojnok (Inst. for Solid State Phys., Eotvos Univ., Budapest, Hungary), Z.Hegedus, L.Tolnai.
Vacuum (GB), vol.33, no.1-2, p.107-10 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
The aim of this work is the study of the electron states of Ni-P compound layers made by an electroless technique using soft X-ray emission spectroscopy (SXES). The information from SXES depends on the thickness and state (amorphous or crystalline) of the samples. There is a systematic change in the emission lines of nickel and phosphorus between the amorphous and crystalline states. In the amorphous state the main peaks are shifted and the fine structure has a blurred shape as compared to the crystalline state. The shift and the fine structure changes in spectra can be explained by the transformation of the chemical bonds and the symmetries within the compounds. The difference in fine structure of the Cu emission line caused by the chemical bonds due to the surface covering is also studied. (13 refs.)

Exchange banding of excited core states and its effects on core-level spectroscopies ....See Entry 72299

79.00 ELECTRON AND ION EMISSION BY LIQUIDS AND SOLIDS; IMPACT PHENOMENA

ECOSS-5. Proceedings of the Fifth European Conference on Surface Science .. ..See Entry 69782

79.20 IMPACT PHENOMENA

(inc. electron spectra and sputtering)

Rutherford scattering in two dimensions ....See Entry 69817

79.20D Laser-light impact phenomena

72894 Laser-induced surface reconstruction of semiconductors and metals. J.M.Moison, M.Bensoussan (Dept. OMT/PMS, CNET, Bagneux, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.294-300 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The authors have investigated the influence of pulsed laser irradiation on the surface structure of Si(111), GaAs(100), InP(100), and Au(100). The surface of these materials shows an equilibrium LEED pattern that can be described by a $(m \times n)$ reconstruction, and no (1×1) pattern is observed at room temperature, except by impurity stabilization. The preparation of a clean (1×1) surface is of interest, because it would lead to a considerably easier theoretical evaluation. Pulsed laser irradiation is now believed to be a means to prepare such surfaces. However, the authors show that the surfaces obtained are not defect-free. They have irradiated clean reconstructed surfaces with increasing laser fluences. Above a threshold fluence, the superstructure LEED spots disappear, leaving only the (1×1) pattern and a slight increased background. A more detailed examination of the LEED patterns reveals a random distribution of steps beside ordered terraces. The step height is nearly equal to the bulk interplanar distance. The interstep spacing ranges from 70 Å for Si to 30 Å for InP and GaAs and 15 Å for Au. It is shown that these steps stabilize the (1×1) pattern. (17 refs.)

Pulse heating of a metal by a laser plasma in a subsonic air flow .... See Entry 71758

High-power laser radiation damage to transparent insulators .. See Entry 72015

79.20F Electron impact: Auger emission

72895 AES and EELS study of hydrogen adsorption, oxygen adsorption and sulphur segregation on a clean titanium surface. F.Pellerin, J.P.Langeron (Centre d'Etudes de Chimie Metallurgique du CNRS, Vitry-sur-Seine, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.444-7 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The Auger electron spectra (AES) and electron energy loss spectra (EELS) of a clean and hydrogen, oxygen, sulphur covered titanium sample were recorded with a cylindrical mirror analyzer. Information on the valence electron density of states is derived from the shape of the $M_{23}VV$ Auger transition of titanium and of the EELS spectrum. It is shown that, while hydrogen or oxygen adsorption induce a resonance 5 eV below the Fermi level, sulphur segregation does not perturb strongly the valence electron levels of titanium. (4 refs.)

72896 Quantitative AES of binary alloys: a comparison between handbook and pseudo-first principles corrections. S.Mroczkowski (Midwest Res. Microscopy Inc., Milwaukee, WI, USA), D.Lichtman.
Surf. Sci. (Netherlands), vol.127, no.1, p.119-34 (April 1983).
Quantitative Auger electron spectroscopy of a number of binary alloys was studied. A pseudo-first principles correction scheme was applied to series of chromium/iron, chromium/nickel, and copper/gold alloys. Peak-to-peak height ratios of differentiated spectra were corrected for elemental differences in ionization cross section, Auger transition probability, atomic density, electron escape depth, backscattering factor, and sputter yield. These corrections changed the original ratio by factors ranging from 1.12 (for the chromium/iron series with a 10 kV primary electron beam) to 4.63 (for the copper/gold series with a 5 kV primary beam). The calculated surface concentrations were compared to wet chemistry bulk concentrations and in all cases, this first principles correction was an improvement over using uncorrected peak height ratios for concentration determination. For a 50/50 at% alloy in each series, the corrected data error for the chromium/iron alloy was 15%, for the chromium/nickel alloy was 2%, and for the copper/gold alloy was 36%. In all series except the chromium/iron system, concentrations obtained using this method had a smaller error than concentrations obtained using sensitivity factors from the Handbook of Auger Electron Spectroscopy. (22 refs.)

72897 Electron beam-solid interactions: implications for high spatial resolution Auger electron spectroscopy. L.L.Levenson (Dept. of Phys. & Energy Sci., Univ. of Colorado, Colorado Springs, CO, USA).
Scanning Electron Microsc. (USA), pt.3, p.925-36 (1982).
Primary electron beams with energies ranging from 10^3 to 10^4 eV and currents between 10^{-3} and 10^{-5} A are commonly used for Auger electron spectroscopy (AES). Electron-electron scattering causes the beam to spread and lose energy as it penetrates the material. The scattering processes are manifested in the energy spectrum of electrons emitted from the surface. This spectrum presents a record of elastic scattering, single and multiple collision inelastic scattering, Auger electron emission, plasmon generation and decay, and secondary electron emission. Electron-electron interactions can cause chemical and structural changes in the sample. Therefore, the spectrum of emitted electrons may change with time. In general, AES requires low effective beam current densities in order to avoid significant electron beam damage. Therefore, low electron beam currents (low nA range) must be used in high spatial resolution AES. Point analysis with a stationary beam may require pA currents to avoid damage when the beam diameter is the order of 10-100 μm. Under all circumstances, ultra high vacuum conditions are needed to avoid electron beam stimulated adsorption or desorption of adsorbed gases. A brief introduction to these subjects is presented. Some guidelines are given for avoiding electron beam damage during high spatial resolution Auger electron spectroscopy. (51 refs.)

72898 The elastic peak in AES and EELS. G.Gergely (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.89-91 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Elastic peak electron spectroscopy (EPES) determines the spectra of secondary electrons in absolute units in the vicinity of the elastic peak including also loss peaks. The percentage of elastically reflected electrons N_e is determined by comparing the peak to total spectrum area. Quantitative data can be deduced from the measurement of the coefficient of secondary emission or electron reflection. N_e is mainly determined by the atomic number for medium energy excitation (1-3.2 keV). It can be used as reference for quantitative AES or EELS. This paper deals with the application of EPES. Results obtained on the backscattering cross section of C, Si, Ge, Mo, W, and Au are presented. The K core level ionization cross section of carbon was determined. The volume plasmon loss process is discussed. EPES was used for evaluating some experimental results on the excitation cross section of a silicon surface state and vibrations of CO adsorbed on Pt have also been determined. (17 refs.)

The effect of ion beams on the composition of $Cu_2O(111)$ surfaces .... See Entry 72189

Oxygen and sulphur influence upon segregation at a nickel-chromium alloy surface .... See Entry 72193

On the interaction of oxygen with Pt single crystals: LEED study of step coalescence .... See Entry 72235

The interaction of CO with Al(111) at room temperature .... See Entry 72240

Kinetics of carbon monoxide adsorption on Re(0001) between 100 and 300K .... See Entry 72241

On the adsorption of oxygen on the Mo{110} surface and its vicinals .... See Entry 72249

Formation of electron structure of (111) Si-Au boundary .... See Entry 72495

Variations of trap states and dangling bonds in CVD Si_3N_4 layer on Si substrate by NH_3/SiH_4 ratio .... See Entry 72527

Binding energy of electrons of surface atoms of oxidized 3d transition metals, obtained by the method of appearance-potential spectroscopy .See Entry 72889

Ion induced surface alterations due to electronic charge exchange and chemical reactions .... See Entry 72915

Ion-neutralization of multiply charged particles near a surface .... See Entry 72931

Interaction between thin films of barium and epitaxial crystals of strontium oxide .... See Entry 72935

The Auger parameter of adsorbed xenon as a probe of surface polarizability .... See Entry 72946

Oxidation of $Hg_{1-x}Cd_xTe$ studied with surface sensitive techniques .... See Entry 73239

AES studies of the oxides formed on iron-chromium alloys at 400°C .... See Entry 73244

79.20H Electron impact: secondary emission

72899 Effect of crystalline structure of a rigid body on elastic reflection of intermediate-energy electrons. V.V.Rumyantsev, V.V.Korablev, V.V.Dubov, Yu.A.Morozov (Leningrad Kalinin Polytech. Inst., Leningrad, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.113-18 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1336-41 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The cross sections of elastic and inelastic electron scattering by large angles in single crystals, like the secondary electron emission coefficients, have a component that oscillates as the angle of incidence θ of primary electrons on the crystal (or their energy E_p) varies. These oscillations are due primarily to diffraction of electrons that penetrate the crystal, which causes, for different angles θ and energies E_p, a change in the conditions of noncoherent scattering of diffracted electrons. Of the entire spectrum of secondary electrons, elastically reflected electrons and electrons that have lost an energy on the order of the plasmon energy are the most sensitive to diffraction processes. Therefore the fine structure is much more evident on the dependences of the elastic scattering coefficient R of electrons on the energy E_p and angle θ, than on the analogous dependences for the coefficients of secondary electron emission σ and inelastic reflection η. The authors generalize the experimental data on the form of the function $R(E_p)$, construct a theory of the phenomenon, and offer a comparison between theory and experiment. The objects of study were single-crystal specimens of (111) Si, (111) Mo, (110) Mo, (112) W, (111) Nb. (4 refs.)

72900 Some features of true secondary electron emission of island-type gold films. S.A.Nepiiko, V.I.Stepkin.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.144-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1367-71 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The studies show that the accuracy in measuring the potential distribution in island-type films by the method of secondary-emission electron spectroscopy is limited primarily by the dependence of the true secondary emission current on the thickness by weight, i.e. on the size and density of the islands per unit surface of the substrate, whereas the shape of the energy distribution of secondary electrons is virtually independent of the thickness. Measurement accuracy can be enhanced by selecting a primary electron energy such that the dependence of the secondary-emission current on the thickness is at a minimum, and by normalizing the energy distribution of secondary electrons with respect to amplitude. (12 refs.)

72901 Application of reciprocity theorem to secondary electron emission of single crystals. M.V.Gomoyunova, I.I.Pronin, D.P.Bernatskii, S.L.Zaslavskii (Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.149-52 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1372-6 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors offer an experimental study of diffraction of primary and secondary electrons of moderate energies by {100} Mo single crystals, and an explanation (involving the use of orientation effects) of secondary electron emission for the range of electron energy losses where the reciprocity theorem is satisfied. Data on anisotropy of excitation and exit of SE are also important in conjunction with the development of quantitative method of electron spectroscopy of surfaces of solids, as well as of scanning reflection electron microscopy. (5 refs.)

72902 Energy structure of surface region of tungsten single crystal as expressed in the secondary-electron spectrum. O.M.Artamonov, O.M.Smirnov, A.N.Terekhov (Leningrad State Univ., Leningrad, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.158-62 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1383-8 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors consider the formation of the energy spectrum of secondary electrons upon emission from the surface layer of crystal, where the energy structure of the layer may differ from the bulk energy structure. Its thickness depends on the preferential electron-scattering mechanism and is defined by the corresponding phenomenological parameters. In the approximation of a constant transition matrix element, for the limiting cases of predominantly elastic or inelastic electron-electron scattering they obtain expressions that relate the energy distribution of SE and the energy structure of the emitting layer of the single crystal. They employ the one-electron approximation. It is shown that a structure appears in the SE spectrum when the energy structure

of the emitting layer of the single crystal cannot be described in the approximation of an almost free electron gas and, as experiments show, it approaches the bulk energy band structure. It is also shown that when the energy structure of the emitting layer is satisfactorily described by the model of an almost free electron gas, the SE spectrum is characterized by the traditional cascade maximum. (11 refs.)

72903 Quantum size effect in electron transmission through Cu and Ag films on W(110). B.T.Jonker, N.C.Bartelt, R.L.Park (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Surf. Sci. (Netherlands), vol.127, no.2, p.183-99 (April 1983).
The transmission coefficient of very low electrons (≤ 10 eV) normally incident on (111) epitaxial films of Cu and Ag on W(110) is modulated by interference between scattering from the vacuum/metal and metal/metal interfaces. Comparison with calculations of free-electron scattering from a one-dimensional potential model, in which grading of the metal/metal interface is represented by a smoothing of the potential step, indicates that this interface is abrupt within approximately one layer spacing. The authors obtain a value of 11.0 (8.0)$\pm$1.0 eV for the inner potential of Cu (Ag) and mean free path lengths of 39$\pm$8 Å at an energy of 7.0 eV relative to the Fermi energy and 29$\pm$11 Å at 9.0 eV for Cu, and 25$\pm$10 Å at 7.5 eV for Ag. Work function values are obtained by the field emission retarding potential technique. They investigate the effects of the surface potential barrier, inelastic scattering and surface roughness, and evaluate the validity of the one-dimensional model presented. (33 refs.)

Proceedings of the XVIII All-Union Conference on Emission Electronics ....See Entry 69775

79.20K Other electron impact phenomena

72904 Scattering of slow electrons by a surface and its relationship to the energy structure. S.A.Komolov (Leningrad State Univ., Leningrad, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.153-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1377-82 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Results concerning scattering of slow electrons on the surface of certain metals and semiconductors, using the method of total-current electron spectroscopy, indicate that groups of substances with similar structures of the valence- and free-state densities are characterized by similar experimental spectra. A detailed analysis of the spectra can reveal the structural features of the state density of particular elements, can determine the energy localization of the extrema of free states, and can estimate the contribution of direct and indirect transitions in electron scattering. In addition to features corresponding the bulk structure of the material, the spectra display differences in the structure of the space density of the surface region and features associated with electron transitions involving surface states. (21 refs.)

72905 Wavevector-resolved electron-energy-loss spectroscopy on the dangling-bond states of Si(111)-(2$\times$1). R.Matz, H.Luth, A.Ritz (Phys. Inst., RWTH, Aachen, Aachen, Germany).
Solid State Commun. (USA), vol.46, no.4, p.343-6 (April 1983).
Low-energy-loss spectra of the clean cleaved Si(111)-(2$\times$1) surface with wavevector resolution are discussed. Parallel to the Γ-J line in the surface Brillouin zone large dispersion in the dangling-bond bands is found near the energy gap at the J-K line. This is in contradiction to the formerly accepted buckling model and favours the recently suggested π-bonded chain model for the (2$\times$1) reconstruction. (12 refs.)

72906 Theoretical and experimental studies of multiple thin-film electron scattering. A.N.Pilyankevich, V.M.Vereshchaka, V.N.Ostapenko, V.Yu.Kulikovskii.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.571-4 (April 1983). In Russian.
Considers principles of the spline-approximation method application to a numerical solution of the problem on multiple radiation flux scattering by a substance. Theoretical and experimental characteristics are given for electrons scattered by thin amorphous objects. Theoretical results in terms of the multiple scattering theory are in good agreement with experimental data. It is shown that the single scattering theory may be applied to describing electron scattering only for small objects whose thickness is much less than the length of a free electron path. (6 refs.)

Partially dissociative adsorption of water vapor on the Si(111)(7$\times$7) surface ....See Entry 72231

The interaction of CO with Al(111) at room temperature ....See Entry 72240

Desorption of negative ions on metallic samples by very low energy electrons .. ..See Entry 72243

Comparison of H$^+$ and H$^-$ ESD from hydrogen on platinum ....See Entry 72245

Nickel carbonyl adsorption on the Ni(111) surface .... See Entry 72247

Interaction of O$_2$ with low index faces of α-CuZn ....See Entry 72248

Formation of electron structure of (111) Si-Au boundary ....See Entry 72495

AES and EELS study of hydrogen adsorption, oxygen adsorption and sulphur segregation on a clean titanium surface .... See Entry 72895

Interaction between thin films of barium and epitaxial crystals of strontium oxide ....See Entry 72935

Symmetry effects in the electron spectroscopy of metals with an ordered adsorbate overlayer ....See Entry 72960

79.20N Atom, molecule, and ion impact

72907 Spatial and energy distributions of incident particles and recoil atoms at finite distances behind a scattering center. L.L.Balashova, A.I.Dodonov, E.S.Mashkova, V.A.Molchanov (Sci. Res. Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.169-74 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1395-400 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Considers the energy and spatial distributions of both scattered particles and of recoil atoms on a plane at a distance D behind the scattering atom, for various ratios of the masses of the incident particles and scattering atom and for various primary-particle energies. Calculations were made within the framework of classical scattering theory. It is shown that the distance from the point of intersection of the asymptotes of the diverging particles to the projection of the initial position of the scattering atom onto the original direction of motion of the incident particles may be comparable not only to the impact parameter but also (in a number of cases) to the interatomic distance. (16 refs.)

72908 Rotational energy distributions in molecule surface scattering: model calculations for NO/Ag(111). J.A.Barker, A.W.Kleyn, D.J.Auerbach (IBM Res. Lab., San Jose, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.9-13 (6 May 1983).
Classical trajectory and quantum-mechanical calculations of finite rotational state distributions are described for a simple model of the scattering of NO from Ag(111) which show strong effects of rotational rainbows. The quantum-mechanical calculation reproduces the general trends of the experimental data quite well. The classical calculation is qualitatively and quantitatively inadequate, an inadequacy which is remarkable in view of the large masses of the particles and the high degree of rotational excitation. (11 refs.)

72909 Cluster-ion emission from an aluminium surface under Cd$^+$ ion bombardment. P.Chakraborty, S.D.Dey (Saha Inst. of Nuclear Phys., Calcutta, India).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.349-51 (15 May 1983).
A special feature of secondary-ion mass spectrometry (SIMS) is the liberation of polyatomic particles (clusters), either in the neutral or ionic state, from ion-bombarded solid surfaces by a sputtering process. The cluster yield is much smaller than that of single atoms or ions. Nevertheless, cluster-ion emission has recently been the subject of extreme interest for the wealth of information it contains about the surface. Some experimental data are reported for secondary Al$^+$, Al$_2{}^+$ and Al$_3{}^+$ intensities from a more or less clean polycrystalline aluminium surface as a function of bombarding Cd$^+$ ion energy in the range 3-10 keV for various values of target current density in the range 100-250 μA cm^{-1}. (10 refs.)

72910 Energy dependence of diffraction intensities: ^{4}He+LiF(001). G.Drolshagen, A.Kaufhold, J.P.Toennies (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
Isr. J. Chem. (Israel), vol.22, no.4, p.283-8 (1982).
The dependence of specular and first order diffraction probabilities on the atom beam energy has been calculated for the system He+LiF(001) in the energy range 18 to 58 meV. A realistic Lennard-Jones-Devonshire atom surface potential with several values of the β-parameter, determining the strength of the corrugated part, was used. A comparison with the predictions of the simple Rayleigh eikonal approximation shows agreement with respect to the overall trends, however the quantal calculations show some deviations and the additional effect of selective adsorption resonances. The results are compared with recent measurements for the $\langle 100 \rangle$ and $\langle 110 \rangle$ directions and good agreement is found for $\beta_{10}=0.086$. (23 refs.)

72911 A study of lineshapes in selective adsorption in atom-surface scattering. V.Celli, D.Evans (Univ. of Virginia, Charlottesville, VA, USA).
Isr. J. Chem. (Israel), vol.22, no.4, p.289-93 (1982).
Calculations are presented involving the scattering of low energy ^{4}He atoms from LiF(001), and compared with experiment. Resonant scattering theory is briefly reviewed, and a prescription for determining the shapes and signatures of resonant features is presented. Inelastic effects are included by means of a Debye-Waller scaling. (8 refs.)

72912 Helium diffraction as a probe of surface structure. T.Engel (Dept. of Chem., Univ. of Washington, Seattle, WA, USA).
Isr. J. Chem. (Israel), vol.22, no.4, p.294-7 (1982).
The diffraction of He atoms from solid surfaces has been recently used to determine the electron distribution of electrons at surfaces. From this, the position of underlying atoms can usually be inferred. Recent developments which test the validity of the hard corrugated wall method to calculate diffraction intensities are discussed. Structural studies which have been carried out to date, on various surfaces with He beams, are tabulated. (46 refs.)

72913 Scattering of N$_2$ from Ag(001). C.W.Muhlhausen, J.A.Serri, J.C.Tully, G.E.Becker, M.J.Cardillo (Bell Labs., Murray Hill, NJ, USA).
Isr. J. Chem. (Israel), vol.22, no.4, p.315-20 (1982).
Experimental and theoretical studies of the scattering of nitrogen molecules from the (001) face of silver are presented. Angular and time-of-flight distributions of the scattered molecules have been measured for incident N$_2$ energies between 7 and 96 kJ/mol, and for surface temperatures between 205 and 600K. Stochastic trajectory simulations have been carried out for the same conditions. Good agreement between experiment and theory has been obtained. The angular distributions are very sensitive to the extent of corrugation of the gas-surface interaction potential, but are relatively insensitive to rotational energy transfer. Scattered velocity distributions also show only a small dependence on rotational energy transfer. (16 refs.)

72914 Quantum-mechanical treatments of rotationally inelastic molecule-surface scattering. D.J.Kouri (Dept. of Chem., Univ. of Houston, Houston, TX, USA), R.B.Gerber.
Isr. J. Chem. (Israel), vol.22, no.4, p.321-8 (1982).
Quantum-mechanical approximation methods and calculations for rotational transitions in molecule-surface collisions are reviewed. The methods are analyzed with regard to predictions of several observable effects: (1) Large ΔJ (rotational quantum number) transitions, and rotational rainbow scattering. (2) The relation between rotational and diffractive transitions. (3) Scaling properties of the rotationally-inelastic scattering amplitudes. (4) Trapping and resonances induced by rotational-translational energy transfer. The methods examined with regard to some of these effects include: coupled-channel calculations; the sudden approximation with regard to both the rotational and the diffractive transitions, and the hard corrugated wall model. It is concluded that whilst available methods provide a qualitative description of the effects mentioned, quantitative treatment of real systems remains an open problem. The main difficulties in formulating a satisfactory quantitative model are examined. Finally, the article presents new results on molecular reorientation processes (ΔM_J transitions) in molecule-surface collisions. It is shown, using the sudden approximation, that molecular reorientation probabilities should reflect sensitively on surface structural corrugation. (41 refs.)

72915 Ion induced surface alterations due to electronic charge exchange and chemical reactions. J.W.Rabalais (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
Isr. J. Chem. (Israel), vol.22, no.4, p.365-74 (1982).
A general discussion of the phenomena that can occur during ion-surface encounters is presented and specific examples of charge exchange processes on LiF surfaces and chemical reactions of N$_2{}^+$ on metals are shown. During rare gas ion bombardment of LiF, ejection of F$^+$ ions and excited Li atoms and the energy distributions of secondary F$^+$ ions can be correlated with Auger primary ion-surface charge exchange transitions determined by the potential energy of the primary ion vacancy and electron promotions resulting from close atomic encounters. Nitridation of Al, Cu, Mo, and Ni to produce very thin nitride surface films is induced by 0-50 eV mass selected N$_2{}^+$ beams. The efficiency of nitridation, monitored by the KL$_2$L$_2$ nitrogen Auger electron signal, exhibits a large kinetic energy E_k dependence below ca. 30 eV. The threshold impact energy for nitridation varies for the different metals; it is nominally zero for Al and Ni, ~4 eV for Mo, probably >0 for Cu, and does not occur at any energy below 200 eV for Ag. That the metal electronic

structure is a critical parameter is evidenced by the facts that different ion doses are required to produce similar nitride signal levels on various metals and that plots of nitride intensity versus E_k exhibit structure or at least different shapes in the low E_k region. A simple quantum mechanical model is used to simulate the nitridation reaction by delineation into four elementary steps: (1) neutralization of incoming N_2^+, (2) decomposition of N_2 into 2N, (3) deexcitation and thermalization of N, and (4) chemical reaction proper. (35 refs.)

72916 An overview of ion sputtering physics and practical implications. J.-C.Pivin (Lab. de Metall. Phys., Univ. Paris-Sud, Orsay, France).
J. Mater. Sci. (GB), vol.18, no.5, p.1267-90 (May 1983).
Surveys the forms of energy exchange between incident ions and target atoms, and the distribution in depth of deposited energy. This analysis is then used to interpret the sputtering yield under various circumstances. A survey is given of the different forms of radiation damage in sputtered targets, with special reference to the many factors that modify the original composition profile: such modification is related to the bombardment conditions used in analytical techniques such as AES, ESCA or SIMS which may be used, inter alia, to determine composition profiles. (101 refs.)

72917 Equilibrium charge states of ^{3}He ions emerging from solid targets at high incident energies. I.Katayama, G.P.A.Berg, W.Hurlimann, S.A.Martin, J.Meissburger, W.Oelert, M.Rogge, J.G.M.Romer, J.L.Tain, B.Styczen (Inst. fur Kernphys., Kernforschungsanlage Julich, Julich, Germany), G.Gaul.
Phys. Rev. A (USA), vol.27, no.5, p.2738-40 (May 1983).
The yield of $^3He^{1+}$ ion produced by a $^3He^{2+}$ beam in C, Al, Ni, Ag, and Au foils was measured at 68, 99, and 130 MeV in order to determine the electron-capture cross sections σ_c. Measurements were performed using targets thicker than 60 $\mu g/cm^2$, where charge equilibrium was found. The results are compared with electron-stripping and -capture theories, which are found to explain fairly well the yield of $^3He^{1+}$. (15 refs.)

72918 Interaction of helium with a metal surface. N.D.Lang (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), J.K.Norskov.
Phys. Rev. B (USA), vol.27, no.8, p.4612-16 (15 April 1983).
It is shown that the binding of a helium atom to a metal surface is well described using the local-density approximation to treat exchange and correlation effects. The self-consistent solution is in turn well approximated by the effective-medium theory. In this theory the interaction is dominated by a repulsive term proportional to the surface electron density. (17 refs.)

72919 Effect of parallel velocity on charge fraction in ion-surface scattering. J.N.M.van Wunnik (FOM-Inst. for Atomic & Molecular Phys., Amsterdam-Watergraafsmeer, Netherlands), R.Brako, K.Makoshi, D.M.Newns.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.618-23 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The negative charge fraction in proton scattering from Cs-covered W(110) is found experimentally to be a strong function of parallel velocity V as well as perpendicular velocity $v_\perp$ entering in previous theoretical treatments. Theory shows that V may be taken into account by displacing the Fermi sphere in existing theory by $Q=mV$. A simple model and a more complete calculation explain the H^+ data. Extension to the case of Na atomic beams on clean W(110) shows that the V-effect is too small to explain discrepancies between theory and experiment at low T. (11 refs.)

72920 Thermal energy helium scattering from CO/Pt(111) at very low coverages. B.Poelsema, R.L.Palmer, S.T.de Zwart, G.Comsa (Inst. fur Grenzflachenforschung und Vakuumphys., KFA Julich, Julich, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.641-6 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Reports on thermal He scattering from CO/Pt(111) at low coverages ($\theta_{CO}<0.01$), which was shown to be dominated by long-range attractive forces centered at the adsorbed CO molecules. The scattering cross section of adsorbed CO is measured as a function of both the velocity of the incident He atoms and the angle of incidence. To a first approximation, the angular dependencies can be understood in terms of simple geometric 'shadowing like' effects. The velocity dependencies, measured at different angles of incidence, coincide on a universal curve after correction for refractive and geometric effects. (13 refs.)

72921 Simultaneous excitation of rotations and surface phonons in the scattering of D_2 from a NaF crystal. G.Brusdeylins, J.P.Toennies (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.647-53 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Angular distributions and time-of-flight spectra have been measured for the scattering of n-D_2 from NaF(001) along the ⟨100⟩ direction at energies between 30 and 90 meV. The angular distributions reveal, in addition to elastic diffraction peaks, additional sharp peaks due to the rotational transitions $0\to1$, $1\to3$, and $0\to4$. The relative rotational transition probabilities show an anomalous behavior which can in part be explained by a kinematic rainbow. An enhancement of rotational transitions in grazing collisions (large θ_i) is also observed. The time of flight spectra confirm the assignments and reveal that phonon processes also are occurring simultaneously with the rotational transitions. (13 refs.)

72922 Enhanced sensitivity of Ne atoms to inelastic scattering by bulk phonons with respect to He/LiF experiments. E.Semerad, E.M.Horl (Inst. fur Metall., Osterreichisches Forschungszentrum Seibersdorf GmbH, Seibersdorf, Austria).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.661-5 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Inelastic scattering of ^{20}Ne atoms from a LiF(001) surface in the ⟨100⟩ azimuth is studied by high resolution time-of-flight measurements. Ne nozzle beams with kinetic energies of 65 and 19 meV and a velocity resolution of $\Delta v/v \sim 0.5\%$ FWHM are used. For both energy regimes, single phonon scattering is found to be the dominant inelastic process. At the present signal-to-noise ratio only interactions of the Ne atoms with acoustic modes can be detected. The major contribution of these interactions is caused by bulk phonons terminating at the surface. The probabilities of the interactions with Rayleigh modes and modes of the acoustic bulk bands show marked differences to He/LiF experiments. (9 refs.)

72923 Quantum model for kinetics of helium atoms near surfaces of free-electron metals. II. Overlap-induced dissipation. B.Gumhalter (Inst. of Phys., Univ. of Zagreb, Zagreb, Yugoslavia), Z.Crljen.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.666-74 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
For pt.I see ibid., vol.117, p.116 (1982). A quantum model developed formerly to describe inelastic collisions of low-energy helium atoms with surfaces of free-electron metals is extended to include the electronically induced dissipative scattering arising from the overlap-induced electron-He atom pseudopotential. It is shown that the repulsive adatom-substrate Hartree-Fock interaction, known to be proportional to the overlap S between the adatom and substrate electronic densities, is succeeded by a series of nonadiabatic higher-order terms which also give rise to dissipative processes in adatom-surface collisions. The leading contribution to this series which contains the information on the decay rate of the adparticle initial state is calculated up to the order S^2 using the formalism of the surface response function developed earlier. Such a formulation does not require the use of any adjustable parameters and the results obtained indicate the importance of this scattering mechanism with respect to the polzarization-induced dissipation discussed in part I. (26 refs.)

72924 Potentials for atom-surface scattering. P.Nordlander (Inst. of Theoretical Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.675-80 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Atom-beam scattering experiments, which provide useful information on the surface structure, are now being performed at a level that makes it crucially important to know the atom-surface potential accurately. As an attempt to provide atom-surface scattering potentials that are simple in form, that apply for different atom-surface combinations by just changing some parameters, and that can include lattice effects, a pseudopotential perturbation approach has been proposed. The first-order term agrees within 15% with the result for jellium. Inclusion of the second-order term gives almost complete agreement in the case of He on Al, thus providing a simple and practically useful method to get accurate atom-surface scattering potentials. Application has also been made to the He-Ag and He-Mg systems. (12 refs.)

72925 Atom scattering by soft-potential surfaces with one-Rayleigh-phonon exchange. N.Garcia, J.M.Soler (Dept. de Fisica Fundamental, Univ. Autonoma, Canto Blanco, Madrid, Spain).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.689-94 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The differential cross sections for atom scattering by surfaces with one-Rayleigh-phonon exchange are calculated using a Debye model for the solid and an exponential potential from the atom-surface interaction. The intensities obtained are considerably lower than those given by a hard wall and depend strongly on the experimental conditions (incident energy and incident and final angles). In some conditions a cut-off appears and this might explain the experimental cut-off observed in Cu(001) and in Ni(111). The Debye-Waller factor effect and the Beeby effect of a well are also calculated and discussed. (8 refs.)

72926 The formation of Ta^+ secondary ions at oxygen-covered Ta surfaces. H.Oechsner, Z.Sroubek (Phys. Inst., Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
Surf. Sci. (Netherlands), vol.127, no.1, p.10-20 (April 1983).
Absolute ionization probabilities R for Ta^+ secondary ions are determined both experimentally from comparative in-situ SNMS and SIMS measurements and theoretically on the basis of recent microscopic ionization theories as a function of the oxygen surface concentration c_O. The theoretically predicted c_O dependence of R for sputtered Ta particles is found to agree well with the experimental results. The comparison between experiment and theory gives quantitative estimates of factors which influence the oxygen induced ion yield enhancement. (19 refs.)

72927 Diffraction of He from Cu(110) in the 20-240 meV range; comparison with a realistic model potential. B.Salanon, G.Armand, J.Perreau, J.Lapujoulade (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Surf. Sci. (Netherlands), vol.127, no.1, p.135-52 (April 1983).
The results of the diffraction of helium from Cu(110) are presented in the 21-240 meV energy range. The corrugated Morse potential gives a good fit but its corrugation amplitude increases with incident energy. A new form of potential, the modified corrugated Morse potential, is presented and its main properties are examined. With this potential, a good fit of the experimental results for various incidence angles is obtained; no change of the parameters is necessary in the whole range of incident energies. So one gets a realistic picture of the He/Cu(110) interaction. (9 refs.)

72928 Rotationally mediated selective adsorption in rigid rotor/rigid surface scattering. R.Schinke (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
Surf. Sci. (Netherlands), vol.127, no.2, p.283-314 (April 1983).
Presents a detailed investigation of a new effect in molecule/surface scattering, rotationally mediated selective adsorption, which has been first observed by Cowin et al. (1981) in rotationally inelastic HD/Pt (111) scattering. It is due to resonance between an asymptotically closed rotational channel and a vibrational bound state of the molecule/surface system. Exact close-coupling and diffractionally sudden calculations are performed for HD scattered from a rigid, flat and weakly corrugated surface. Both variation of the collision energy and variation of the incident angle are considered. In the latter case the author includes the averaging over the collision energy of the initial beam and compares qualitatively the results with experiment. Taking into account the resonances below the $j=0\to1$ threshold he is able to explain all of the experimentally observed resonances and to assign them with the appropriate rotational-vibrational quantum numbers. The largest deviation between experimental and theoretical resonance angles is $\sim1.6°$ at a collision energy of $E=109$ meV. An interesting interference effect is found in the case of weak surface corrugation. Although the diffractionally sudden approximation generally gives only poor results, it also reproduces this effect and provides a simple explanation of it in terms of the Breit-Wigner representation of the S-matrix. (41 refs.)

72929 The effect of oxygen on the sputtering of metastable atoms and ions from Ba metal. D.Grischkowsky, M.L.Yu, A.C.Balant (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Surf. Sci. (Netherlands), vol.127, no.2, p.315-30 (April 1983).
By means of the Doppler-shift-laser-fluorescence technique the authors have measured the effect of oxygen coverage on the velocity distributions and relative yields of sputtered Ba atoms and ions in both the ground and metastable excited states. The measurements show no evidence that the excitation probabilities are correlated with the magnitude of the electric-dipole-moment

matrix element to the ground state. They also find that the excitation probability of the Ba(^{1}D) state from a clean metal surface depends strongly on the emission velocity ν and approaches the functional form exp $(-A/a\nu)$ at higher velocities. (33 refs.)

72930 Metastable de-excitation and ion neutralization near a surface. C.Boiziau (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Scanning Electron Microsc. (USA), pt.3, p.949-59 (1982).
Gives a overall picture of the interaction mechanisms taking place when slow ions or metastable atoms arrive in the close proximity of a solid surface. It is shown that the electronic emission process is essentially governed by the overlapping wave functions of the metastable level of the incident atom (ionized or excited) and the electronic levels of the surface: either the electronic emission is due to an auger neutralization, or it is due to an Auger de-excitation. But in both cases, the electronic energy distribution contains information from the outer part of the solid-vacuum interface; it is also emphasized that no significant modifications are made to the interface itself. On these basis, two spectroscopies are described: INS (Ion Neutralization Spectroscopy) and MDS (Metastable De-excitation Spectroscopy). Experimental results confirm the theoretical predictions. (43 refs.)

72931 Ion-neutralization of multiply charged particles near a surface. P.Varga, W.Hofer, H.Winter (Inst. fur Allgemeine Phys., Tech. Univ. Wien, Wien, Austria).
Scanning Electron Microsc. (USA), pt.3, p.967-71 (1982).
The interaction of slow multiply charged rare gas ions with surfaces was tested by accelerating and decelerating both singly and multiply charged ions. Target current and current of secondary electrons emitted onto a collector were measured in order to determine the electron yield. Retarding grids were used to measure ejected electron-energy distributions. The experiment represents a stepwise neutralization in a sequence of Auger-de-excitation (AD) and Auger-neutralization (AN) processes for doubly charged neon ions. The first neutralization step was found to involve either Resonance neutralization (RN)+AD or AN into excited ion states. Increasing the ion energy caused the characteristic distribution peaks to disappear. Although stepwise neutralization takes place at higher ion energies also, the level broadening smooths any structure that may have originated at the electronic structure of the surface. (10 refs.)

72932 SIMS depth profiling of Cr-Ni multilayer targets. J.Giber, D.Marton, J.Laszlo, A.Hanusovszky, P.Stingeder (Phys. Inst., Tech. Univ., Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.117-20 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Measured depth profiles of multilayer Cr-Ni structures with 15-24 layers of 4-10 nm individual layer thickness are presented. A Balzers SIMS with 3 keV Ar^+ ions was used. Ni^+, Cr^+, NiO^+, CrO^+, $Ni_2{}^+$, $Cr_2{}^+$ and $NiCr^+$ ions were detected in reactive and non-reactive measurements. Starting out from the measured depth profiles, the authors obtained relative depth resolution vs. depth functions by a special definition of the absolute resolution. These measurements show that the SIMS itself is able to give valuable depth resolution functions. The absolute depth resolution can be 1-2 nm in optimal cases. (8 refs.)

72933 Computer simulation of the sputtering-induced composition change in Cu-Au, Cu-Ni and Cu-Pd alloys in the initial period of depth profiling. L.Fustoss, J.Laszlo, J.Giber (Phys. Inst., Tech. Univ., Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.121-4 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
The authors have developed a simulation model for examining the characteristics of the sputtering process of metal targets forming a face-centered cubic lattice. In their model the composition of the metal, the features of the lattice determining the cascade mixing and the interaction potentials can be changed. Also the mass and energy of the bombarding particles can be varied. The changes in the concentration profile for binary alloys can be determined by the registration of the composition change of the atomic layers. The authors can also analyse the dependence of the concentration changes in the topmost few layers on the masses of the component atoms and on their displacement energies. Besides the verification of the tendencies they have compared their calculations with experimental results for Cu-Au, Cu-Ni and Cu-Pd alloys. The experimental trends can be well explained with the authors' model. (31 refs.)

Dissociation dynamics in high-energy molecule-surface collisions: the dissociation rainbow effect .... See Entry 70967

He diffraction studies of Pt(110) (1×2) .... See Entry 72199

Study of the Ag(110) surface by He diffraction .... See Entry 72200

Study of organic surfaces with UPS and metastable deexcitation spectroscopy .... See Entry 72202

A helium diffraction study of the reconstructed Au(100) surface .... See Entry 72204

The spectroscopy of surface vibrations in ionic crystals by inelastic scattering of atoms .... See Entry 72209

Rotationally mediated selective adsorption as a probe of isotropic and anisotropic molecule-surface interaction potentials: HD(*J*)/Ag(111) ..See Entry 72224

Interaction of NO$_2$ with a Pt(111) surface .... See Entry 72226

Diatomic molecules and metallic adhesion, cohesion, and chemisorption: a single binding-energy relation .... See Entry 72339

Use of secondary ion emission for investigating the distribution profiles of elements and compounds in various film compositions .... See Entry 73382

79.20R Atomic and molecular beam interactions

Study of the Ag(110) surface by He diffraction .... See Entry 72200

Enhanced sensitivity of Ne atoms to inelastic scattering by bulk phonons with respect to He/LiF experiments .... See Entry 72922

79.40 THERMIONIC EMISSION

72934 Use of ion-scattering spectroscopy for investigating processes on the surface of efficient thermoemitters. A.B.Tolstoguzov, G.N.Shuppe (Ryazan Radioengng. Inst., Ryazan, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.54-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1275-7 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors employ ion-scattering spectroscopy to investigate processes on the surface of efficient thermoemitters (ETE). The latter can provide model systems with an element composition of the uppermost atomic layer that varies in relation to the temperature. On the one hand, the work is aimed at clarifying a number of debatable aspects of the ETE mechanism; on the other hand, it was intended to enhance the popularity of the low energy backscattered ion-spectroscopy (LEBSIS) method and to promote its more widespread deployment for scientific and engineering purposes. (9 refs.)

72935 Interaction between thin films of barium and epitaxial crystals of strontium oxide. A.N.Andronov, S.V.Malyshev, N.A.Pronina (Kalinin Leningrad Polytech. Inst., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.129-33 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1352-6 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Auger electron spectroscopy (AES), ionization spectroscopy (IS), total-current spectroscopy (TCS), slow electron diffraction (SED), and contact potential difference (CPD) are employed to investigate the position, structure, and work function of thin layers of barium on the surface of monocrystalline films of strontium oxide. Films were deposited and their properties investigated in an ultra-high-vacuum ($p\sim5\times10^{-8}$ Pa) experimental device equipped with an electron-beam evaporator and a three-grid energy analyzer with a retarding field. The substrates were provided by the (100) and (110) faces of a molybdenum single crystal. (7 refs.)

72936 Some aspects of thermoemission of cathodes based on lanthanum and yttrium oxides. V.I.Podgornyi (Inst. of Radio Engng. & Electronics, Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.190-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1416-19 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The authors have shown that holding of cathodes based on Y_2O_3 and La_2O_3 at the activation temperatures for $\tau=2$-3 hr, with subsequent cooling, results in a surface state with enhanced thermoemission activity. They have established that holding of cathodes in an electric field of positive polarity leads to a $\sim$0.35 eV reduction in the thermoemission activity of lanthanum oxide, and to a $\sim$0.05 eV reduction for yttrium oxide, as compared to holding in a field of negative polarity. The effect can be linked to changes in concentration of metal adatoms on the cathode surface. (7 refs.)

72937 Electroforming and electron emission of carbon thin films. H.Araki (Electron Beam Lab., Osaka Univ., Osaka, Japan), O.Hirabaru, T.Hanawa.
J. Vac. Soc. Jpn. (Japan), vol.26, no.1, p.22-9 (1983). In Japanese.
Develops the fabrication techniques of a thin film electron emitter. Devices with good reproducibility and stability were obtained when carbon films were deposited on a Corning 7059 glass rubbed with emery paper (#1000), and were heat-treated at 600°C in high vacuum. When the input power density to the devices attained to about 2.4×10^8 W/cm^3, the carbon films were locally broken due to the joule heating and electron emission from the devices were detected. The *I-V* characteristics after the forming were similar to those of the electroformed MIM type devices, and the emission efficiencies were $(2\sim6)\times10^{-4}$. (7 refs.)

Adsorption of barium on the (110) and (111) faces of molybdenum .... See Entry 72219

79.60 PHOTOEMISSION AND PHOTOELECTRON SPECTRA

72938 Study of morphology and composition of Pt-black catalysts. III. XPS study of Pt-black. Z.Paal, P.Tetenyi (Inst. of Isotopes, Acad. of Sci., Budapest, Hungary), D.Prigge, X.Z.Wang, G.Ertl.
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.307-20 (March 1983).
For pt.II see ibid., vol.14, p.101 (1982-83). Samples of Pt-black reduced in aqueous medium by HCHO and subjected to sintering in hydrogen at different temperatures were studied by XPS. Most of the platinum surface is covered by oxygen and carbon. The presence of small amounts of Si has been confirmed. The ratio of Pt $4f_{7/2}$ to $4f_{5/2}$ peak intensities indicates that a considerable fraction of the surface Pt atoms is in an oxidized state, bound to oxygen and, presumably, also to surface CO. The double O 1 s peak confirms the presence of two types of oxygen (Pt-O and CO, respectively). In situ hydrogenation removes oxygen from Pt-O as well as carbon from PtC_x species, leaving most of the surface CO intact. (34 refs.)

72939 Energy-band structure of copper iodide [photoelectron spectra]. V.K.Adamchuk, G.V.Prudnikova, A.B.Smirnov, Yu.A.Shuba (Leningrad State Univ., Leningrad, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.109-12 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1332-5 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The observed structure of the photoelectron spectra in the region $h\nu\geq10.8$ eV is explained by excitation as a result of direct transitions in the regions of points Γ and X of the Brillouin zone of copper iodide. The authors determined the energies of the flat portions of the valence bands in the region of point X: -1.8; -2.9; -4.3 eV and in the region of point Γ: -0.8 eV. The energies of singular points in the conduction band of copper iodide are, in the region of point X: 6.4; 6.7 eV; in the region of Γ: 9.6 eV. (7 refs.)

72940 Mechanism of escape of photoelectrons from photocathodes with negative electron affinity. A.L.Musatov, V.L.Korotkikh (Inst. of Radio Engng. & Electronics, Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.134-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1357-60 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
Photocathodes with negative electron affinity (NEA) are highly doped p-type semiconductors, whose work function is reduced by adsorption of cesium and oxygen in such a way that the vacuum level lies below the bottom of the conduction band in the bulk of the semiconductor. The authors conducted a cycle of studies of the work function and photoelectron spectra of GaAs and GaInAs photocathodes, which yielded new conceptions of the mechanism of

escape of photoelectrons from NEA photocathodes. They present the principal experimental findings obtained in this cycle of studies, and offer a detailed analysis and a new model of photoemission from NEA photocathodes. (15 refs.)

72941 Comparative investigation of the formation of an activating coating of photocathodes based on mono- and polycrystalline gallium arsenide. L.I.Antonova.

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.138-40 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1361-3 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).

Polycrystalline layers (PL) of gallium arsenide were grown by the gas-phase epitaxial method on molybdenum substrates; epitaxial structures (ES) of gallium arsenide were prepared by the liquid-phase method on monocrystalline gallium arsenide. It is shown that activating coatings cannot be the determining factor in differences in efficiency of emitters based on PL and ES of gallium arsenide. The main factor lies in the structure of these layers itself. Estimates of the diffusion length of minority carriers in the most efficient PL cathodes yield 4-5 μm. Consequently, the minimum dimension of the crystal should in any case be no less than 2L, i.e. 10 μm, something that does not always occur in reality. The size degree of perfection, directional growth, and surface purity of single crystals are the chief factors that foster enhanced photosensitivity of cathodes. (2 refs.)

72942 Screening of electric field and photosensitivity of InSb cathodes. S.I.Baranchuk, N.V.Mileshkina (Leningrad State Univ., Leningrad, USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.141-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1364-6 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).

The operation of semiconductor field-effect cathodes in the mode of photosensitive emission is determined by the conditions of absence of electric breakdown and screening of the external emission field by the surface region. The authors measure the I-V characteristics of an InSb field-effect cathode and the change in emission after laser illumination. The loss of photosensitivity during operation is investigated by SEM studies of the surface. (7 refs.)

72943 Photostimulated exoemission from some organic compounds. I.V.Krylova, M.Ya.Mel'nikov (Moscow State Univ., Moscow, USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.186-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1412-15 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).

The authors' approach to phenomena of photostimulated emission from organic compounds, based on simultaneous recording of the photocurrent and of photochemical conversions (e.g. by the EPR method), makes it possible to clarify the mechanism of formation of surface traps under illumination, the mechanism of stabilization of the resultant charges, and the nature of the trap. An approach based on simultaneous investigation of electrical phenomena and the chemical action of charged-particle fluxes has recently been developed for the study of microprocesses of capture of charged carriers in the formation of electrets. (8 refs.)

72944 Dielectric dispersion in optical electron transfer in solution. P.Delahay (Dept. of Chem., New York Univ., New York, NY, USA).

Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.613-18 (29 April 1983).

Dielectric dispersion causes the outer-sphere reorganization free energy to vary with photon energy in optical electron transfer. The resulting distortion of the spectral response for photoelectron emission may yield misleading evidence about the emission yield versus photon energy relationship. Dispersion is taken into account in the calculation of emission threshold energies and the correlation between optical and thermal electron transfer. Results are given for V^{2+}, Cr^{2+}, Mn^{2+}, Fe^{2+}, Co^{2+}, $Fe(CN)_6{}^{4-}$. (23 refs.)

72945 Ionization potentials of 1:1 alternating copolymers containing a pendant carbazolyl group as determined by UV photoelectron spectroscopy. Y.Shirota, Y.Matsumoto, H.Mikawa (Dept. of Appl. Chem., Osaka Univ., Osaka, Japan), K.Seki, H.Inokuchi.

Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.57-9 (6 May 1983).

UV photoelectron spectra of poly(N-vinylcarbazole) (PVCz) and 1:1 alternating copolymers of N-vinylcarbazole in thin films have been measured to determine their threshold ionization potentials ($I_s{}^{th}$). The $I_s{}^{th}$ values of the copolymers are found to be higher than that of PVCz by 0.1 to 0.3 eV. (14 refs.)

72946 The Auger parameter of adsorbed xenon as a probe of surface polarizability. P.C.Stair (Dept. of Chem., Northwestern Univ., Evanston, IL, USA).

Isr. J. Chem. (Israel), vol.22, no.4, p.380-5 (1982).

The change in Auger parameter, α (α=Auger kinetic energy minus photoelectron kinetic energy from core levels) between gas phase and adsorbed phase xenon provides an unambiguous measure of final state electronic relaxation in the surface toward the xenon ion. For many surfaces this relaxation is purely electronic polarization in the surface so that the Auger parameter provides a measure of the surface polarizability. Moreover, the Auger parameter for adsorbed xenon can be related to the relaxation energy in core level photoemission with high accuracy. Measurement of the xenon Auger parameter and its sensitivity to surface dielectric properties is illustrated by experiments on a series of oxygen treated Mo(100) surfaces. (29 refs.)

72947 A study of the core level electrons in iron and its three oxides by means of X-ray photoelectron spectroscopy. P.Mills, J.L.Sullivan (Dept. of Phys., Univ. of Aston, Birmingham, England).

J. Phys. D (GB), vol.16, no.5, p.723-32 (14 May 1983).

The core level electrons in iron and its three oxides FeO, Fe_3O_4 and α-Fe_2O_3 have been studied by means of X-ray photoelectron spectroscopy. The main features of the spectra have been identified and electron binding energies have been measured. The Fe 2p peaks of the oxide spectra are broadened (FWHM$\sim$4.5 eV) due to unresolved multiplet splitting, and shake-up satellites can be observed for both Fe^{II} and Fe^{III} species. For all the samples studied the O 1s spectra consist of two overlapping peaks, one due to the oxide and a higher binding energy peak due to an adsorbed species. The higher binding energy peak was frequently dominant indicating a high degree of absorption on the oxide surfaces. The effect of argon ion etching on the surfaces has also been investigated and the results indicate that the analysis of surfaces by means of ion etching in conjunction with XPS can give misleading results. (9 refs.)

72948 Observation of spin-split electronic states in solids by energy-, angle-, and spin-resolved photoemission. R.Raue, H.Hopster, R.Clauberg (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).

Phys. Rev. Lett. (USA), vol.50, no.20, p.1623-6 (16 May 1983).

The combination of high energy and angle resolution (100 meV, ±3°) with spin analysis in photoemission spectroscopy is shown to allow the direct observation of magnetically spin-split electronic states. This is demonstrated for normal emission from Ni(110) with polarised Ne I radiation ($h\nu$=16.85 eV). It is found that Δ_{ex}=0.18 eV for the exchange splitting of the S_4 band at the X point in good agreement with a band-structure and photo-emission calculation that considers the self-energy correction explicitly. (16 refs.)

72949 Evidence for interference between direct and inner-shell-deexcitation photoemission in semiconductors. K.L.I.Kobayashi (Optoelectronics Joint Res. Lab., Kawasaki, Japan), H.Diamon, N.Watanabe, M.Taniguchi, S.Suga, H.Nakashima, Y.Murata.

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.57-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Photoemission study of Si(111), GaAs(110), and InSb(110) cleaved surfaces is performed in the photon energy range from 30 eV to 130 eV using synchrotron radiation. Anomalous intensity variation with strong line shape modulation is observed in the vicinity of Si 2p, As 3d, and Sb 4d core excitation threshold. The present results are interpreted to be due to interference between direct valence band emission and inner shell deexcitation. Many body effects are found to manifest in the inner shell excitation regime in these wide valence band semiconductors. (13 refs.)

72950 A study of the valence band structure of $Ga_{0.47}In_{0.53}As$ by angle resolved photoemission. J.E.Rowe, T.P.Pearsall, R.A.Logan (Bell Labs., Murray Hill, NJ, USA).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.347-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Angle-resolved ultraviolet photoemission has been used to determine the E-k dispersion along the [$1\bar{1}0$] direction of the surface Brillouin zone. The experimental results indicate that the upper-most valence band in $Ga_{0.47}In_{0.53}As$ is somewhat more flat along [$1\bar{1}0$] than a virtual-crystal model band structure would suggest. The quasi one-dimensional density of states measured along the [111] direction indicates that the L_3 minimum occurs at -1.60 eV below the valence band edge. (9 refs.)

72951 Study of III-V semiconductor band structure by synchrotron photoemission. G.P.Williams, F.Cerrina, J.Anderson, G.J.Lapeyre, R.J.Smith, J.Hermanson, J.A.Knapp (Dept. of Phys., Montana State Univ., Bozeman, MT, USA).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.350-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Angle-resolved synchrotron photoemission studies of six III-V semiconductors have been carried out. For emission normal to the (110) plane of these materials, peaks in the experimental spectra were identified with the bands involved in the transitions, and the critical point energies X_3, X_5, and $\Sigma_1{}^{min}$, were determined. The data indicate that $k_\perp$ is conserved in the transitions. Comparison of the data with theoretical bands permits an evaluation of $k_\perp$ associated with the experimentally observed transition, and from this information the bands were plotted out. (4 refs.)

72952 Site determination for palladium on niobium using angle-resolved photoemission. M.El-Batanouny, M.Strongin, G.P.Williams (Brookhaven Nat. Lab., Upton, NY, USA).

Phys. Rev. B (USA), vol.27, no.8, p.4580-5 (15 April 1983).

The authors demonstrate the possibility of using angle-resolved photoemission from valence levels to gain overlayer site geometry information. To do this they utilize and discuss polarization effects and photoexcitation cross-section effects (as a function of the photon energy). To illustrate the application of the technique they have studied Pd overlayers on Nb(110) and conclude that the Pd(110) overlayer has a hollow-site geometry. (11 refs.)

72953 Photoelectron-diffraction analysis of the structure of c(2×2)O on Ni(001). S.Y.Tong (Dept. of Phys., Univ. of Wisconsin, Milwaukee, WI, USA), W.M.Kang, D.H.Rosenblatt, J.G.Tobin, D.A.Shirley.

Phys. Rev. B (USA), vol.27, no.8, p.4632-6 (15 April 1983).

Calculated energy-dependent photoelectron-diffraction (EDPD) curves for oxygen-nickel perpendicular spacings ($d_\perp$) between 0.0 and 1.2 Å are presented and compared with experimental data for the c(2×2)O-Ni(001) system. Using a normalized R factor, the authors found that only acceptable agreement is for $d_\perp$ spacings in the range 0.78-0.90 Å. The experimental observations that adsorbate-induced modulations remains strong over a wide energy range in EDPD curves, but not in low-energy electron-diffraction intensity curves, is explained. (18 refs.)

72954 Calculation of spin-polarized threshold photoemission from the Ni(001), Ni(111), and Ni(110) surfaces. R.Clauberg (Inst. fur Festkorperforschung, KFA Julich GmbH, Julich, Germany).

Phys. Rev. B (USA), vol.27, no.8, p.4644-53 (15 April 1983).

Calculations of spin-polarized threshold-photoemission spectra of Ni(001), Ni(111), and Ni(110) surfaces are presented, obtained with a one-step model of the photoemission process. As in the previous work of Moore and Pendry (1978), good agreement with the angle-integrated experimental results for emission from the (001) and (111) surfaces is obtained within a normal-emission approximation. In contrast, for emission from the (110) surface it is found that the angle-integrated spectra are dominated by nonnormal-emission contributions. In addition, the influences of relativistic dipole selection rules and surface-state emission on the spin polarization from the (110) surface are discussed briefly. (30 refs.)

72955 Angle-resolved photoemission studies of GaAs(100) surfaces grown by molecular-beam epitaxy. T.-C.Chiang (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), R.Ludeke, M.Aono, G.Landgren, F.J.Himpsel, D.E.Eastman.

Phys. Rev. B (USA), vol.27, no.8, p.4770-8 (15 April 1983).

Angle-resolved photoemission techniques were used to study GaAs(100) surfaces grown by molecular-beam epitaxy. Three well-ordered surfaces with the c(4×4), c(2×8), and c(6×4) reconstructed surface structures and a disordered As-covered (1×1) surface were investigated in the photon-energy range of 12-70 eV. All major sharp peaks in the normal-emission spectra were found to be transitions from bulk valence bands; therefore, transitions due to surface states were either weak or broad. The variations in bulk-peak intensities for different surface structures were related to surface diffraction effects For photon energies greater than about 20 eV, primary-cone peaks for transitions from the upper bulk valence bands to a broadened and shifted free-electron-like final band were identified, and energy dispersion relations for the upper valence bands were determined along the [100] direction. Surface umklapp transitions were quite strong due to the presence of many short surface reciprocal-lattice vectors. To characterize these surfaces, angle-integrated photoemission measurements of valence bands and core levels were made, and the positions of the Fermi level for these surfaces were detemined. (17 refs.)

72956 X-ray photoelectron spectra of the spinel systems $\mathrm{CdCr_xIn_{2-x}S_4}$ and $\mathrm{ZnCr_xAl_{2-x}S_4}$. C.Battistoni, E.Paparazzo (CNR, Rome, Italy), Y.Dumond, M.Nogues.

Solid State Commun. (USA), vol.46, no.4, p.333-6 (April 1983).

XPS spectra of $\mathrm{CdCr_xIn_{2-x}}S_4$ and $\mathrm{ZnCr_xAl_{2-x}}S_4$ spinel solid solutions are reported. A nearly constant electron density is found over all atomic sites in both series in the whole range of concentration x; this situation is related to covalency. Some interesting features in the Cr3*s* multiplet splitting are discussed. (16 refs.)

72957 Adsorbate-induced umklapp processes in photoemission from Cl on Cu. D.Westphal, A.Goldmann (Lab. fur Festkorperphys., Univ. GH Duisburg, Duisburg, Germany).

Surf. Sci. (Netherlands), vol.126, no.1-3, p.253-7 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).

The authors have studied high-resolution angle-resolved photoemission from Cu(001)-c(2×2)-Cl, Cu(111) $(\sqrt{3}\times\sqrt{3})$R30°-Cl and the clean substrates. Drastic changes of spectral features which occur after adsorption in the energy region of the substrate d-band emission are clearly identified as surface umklapp processes involving reciprocal lattice vectors of the adsorbate. They discuss some implications of their results for the interpretation of angle-resolved photoemission adsorbate studies. (9 refs.)

72958 Photoemission from low-dimensional systems. C.Binns, C.Norris, G.C.Smith, H.A.Padmore (Dept. of Phys., Univ. of Leicester, Leicester, England), M.G.Barthes-Labrousse.

Surf. Sci. (Netherlands), vol.126, no.1-3, p.258-64 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).

The variety of monolayer and submonolayer structures which characterize metallic overlayers supported on single crystal metal substrates offers a valuable opportunity to observe the influence of reduced dimensionality on the electronic states. The authors report results for several systems which illustrate this. (13 refs.)

72959 Photoelectron spectroscopic studies of the adsorption geometry on Ni single crystals: p(2×2), c(2×2) overlayers on Ni(100) and (2×1) symmetry on Ni(110). C.Benndorf, C.Nobl, F.Thieme (Inst. fur Phys. Chem., Univ. Hamburg, Hamburg, Germany).

Surf. Sci. (Netherlands), vol.126, no.1-3, p.265-72 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).

The oxygen induced p(2×2) and c(2×2) LEED symmetries on Ni(100) were studied with UPS He I (s- and p-polarization), He II and XPS (O 1s and XAES O(KLL) spectra), revealing only some minor differences between both states. In the UPS He II analyzed under a polar angle of 45° in the [100] azimuthal direction, the half width of the O 2p maximum from the c(2×2) overlayer increases to $\Delta E=2.5$ eV, suggested to be due to a splitting of the 2p levels. During the transition from p(2×2) to c(2×2), with XPS, only a small increase of the O 1s BE from 529.9 to 530.1 eV is observed, whereas the X-ray excited $\mathrm{O(KL_{23}L_{23})}$ peak shifted from 514.3 to 515.0 eV. In contrast to the results from the p(2×2) and c(2×2) overlayers on Ni(100), where the O 2p intensity nearly vanishes with s-polarization, the O 2p emission from the (2×1) structure on Ni(110) is found to be less dependent from the polarization, The O 2p intensity profile, measured as a function of polar angle in the [100] and [110] azimuthal direction, is nearly identical in both cases. (12 refs.)

72960 Symmetry effects in the electron spectroscopy of metals with an ordered adsorbate overlayer. N.V.Richardson (Donnan Labs., Univ. of Liverpool, Liverpool, England).

Surf. Sci. (Netherlands), vol.126, no.1-3, p.337-48 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).

The influence which an adsorbate may have on the dipole activity of substrate based electron and phonon excitations is discussed. The presence of ordered adsorbate overlayers gives rise to new substrate phonons in specular EELS experiments and new substrate features in photoemission. More importantly, the appearance of these features is shown to be directly related to the particular adsorption site which is occupied. The p(2×2) and c(2×2) overlayers on square lattices as well as $(\sqrt{3}\times\sqrt{3})$R30° and p(2×2) overlayers on hexagonal lattices are considered in some detail. Examples are provided by photoemission results for c(2×2)-Br/Cu(001) and by various EELS studies by Andersson and Persson (1981), and by Ibach and Bruchmann (1980). (15 refs.)

72961 Photoemission study of oxygen adsorbed on coldly deposited silver films. J.Eickmans, A.Goldmann, A.Otto (Phys. Inst. III, Univ. Dusseldorf, Dusseldorf, Germany).

Surf. Sci. (Netherlands), vol.127, no.1, p.153-64 (April 1983).

UPS of coldly deposited silver films differ from those of films deposited at room temperature by electronic states localized at surface defects with an energy about 4.2 eV below E_F. Changes after exposure at 140K to oxygen only occur in the presence of these defects, demonstrating that oxygen is only adsorbed at defects. Raman vibrational spectroscopy shows that oxygen is adsorbed nominally at $\mathrm{O_2^{-}}$ and $\mathrm{O_2^{2-}}$. Possible assignments of the oxygen related UPS structures are discussed. (44 refs.)

72962 Lineshape studies of the X-ray photoemission of small metal clusters. T.T.P.Cheung (Phillips Res. Center, Phillips Petroleum Co., Bartlesville, OK, USA).

Surf. Sci. (Netherlands), vol.127, no.2, p.L129-34 (April 1983).

It is shown that the lineshape asymmetry of the X-ray photoelectron spectra of the Pt(4f) and Pd(3d) core-levels in small clusters decreases with the size of the cluster. Such changes are related to the changes of the density of states of the valence electrons and the effective core-hole potential at the Fermi level. The decrease of the asymmetry leads to a shift of the line position toward a higher binding energy (about half of the observed shift) as governed by the first moment rule. (12 refs.)

72963 XPS investigation of stainless steel surfaces heated in aqueous media. L.Kover, I.Kadar, I.Cserny, J.Toth (Inst. of Nuclear Res., Hungarian Acad. of Sci., Debrecen, Hungary).

Vacuum (GB), vol.33, no.1-2, p.99-105 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).

X-ray photoelectron spectroscopy combined with argon ion etching was used for the investigation of the structure of the oxide layers developed on stainless steel surfaces having been exposed to ion-free water of different temperatures. Photoelectron intensity ratios measured as a function of the ion etching time give information on the composition and depth structure of the oxide layer as well as of the uppermost layers of the alloy. Stainless steel samples of three different types were exposed to the effect of ion and oxygen free water at 20°C and 250°C. In the case of the low temperature (20°C) environment a ~3 nm thick oxide layer could be observed, while the oxide layers developed at high (250°C) temperature treatment were thicker than 8 nm. Samples of the three alloys showed very different chromium enrichment in the oxide layer and chromium depletion in the uppermost layer of the bulk. Results obtained make it possible to follow the effect of a given corrosive environment on the surface, and help to select the proper alloy for this environment. (23 refs.)

72964 Azimuthal X-ray photoelectron diffraction from adsorbate core levels. P.J.Orders, C.S.Fadley, R.Trehan, B.Sinkovic (Dept. of Chem., Univ. of Hawaii, Honolulu, HI, USA), Z.Hussain, J.Lecante.

Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.37-8

X-ray photoelectron diffraction (XPD) associated with core-level emission shows considerable promise as a surface structural probe. Prior studies utilizing standard unpolarized X-ray sources at $h\nu\approx1.5$ keV exhibit considerable fine structure and overall anisotropies $\Delta I/I_{max}$ of up to ~40%. Such data often show strong forward scattering effects that can provide information on bond directions between two surface atoms, and it is also found that azimuthal scans can be analyzed in terms of a very simple single-scattering cluster model so as to yield bonding sites and bond distances for chemisorbed species. All prior work in this area has involved unpolarized sources and relatively high photoelectron energies of $\sim10^3$ eV. This study represents a first exploration of azimuthal XPD with synchrotron radiation. The JUMBO monochromator and a VG ADES 400 photoelectron spectrometer were used to carry out the measurements. (5 refs.)

72965 Angle-resolved photoemission studies of the CdS band structure. N.G.Stoffel, G.Margaritondo (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).

Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.49

The authors present the first angle-resolved photoemission study of the band structure of a II-VI compound. The electronic states of wurtzite CdS have been mapped using synchrotron radiation in the 7-35 eV range. By employing both normal and off-normal detection geometries, energies for the upper valence band have been determined for high-symmetry points in the Brillouin zone. Polarization selection rules have greatly facilitated the interpretation of the spectra. Comparison with the results show that the existing calculations predict the correct relative positions of the critical points, but consistently underestimate the dispersion of the valence bands by about 35%. The Cd4d 'core levels' lie within the valence band and exhibit dispersion and an additional split-off low binding energy peak. This is interpreted as a bulk band structure effect as opposed to a surface shift. Furthermore, crystal-field splitting alone cannot account for this effect. Therefore, the Cd4d levels should be taken into account in any realistic band structure calculations. (no refs.)

72966 Angle-resolved energy-dependent photoelectron-diffraction of c(2×2) O-Ni(001): a surface structural determination. S.Y.Tong, W.M.Kang (Lab. for Surface Studies, Univ. of Wisconsin, Milwaukee, WI, USA), D.H.Rosenblatt, J.G.Tobin, D.A.Shirley.

Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.53

The c(2×2) and p(2×2) O on Ni(001) systems have been studied by many surface techniques to determine the binding distance of O on nickel. The authors have analyzed the c(2×2) O-Ni(001) system by angle-resolved energy-dependent photoelectron diffraction (EDPD). They calculate EDPD curves by varying the O-Ni spacing from 0 Å to 1.3 Å in steps of 0.05 Å. After comparison with measured EDPD data, they find good agreement at $d_\perp=0.85$ Å and poor agreement in the range $0.0\leq d_\perp\leq0.3$ Å. (no refs.)

72967 Photoemission and photoabsorption of amorphous Si films. D.Wesner, W.Eberhardt (Brookhaven Nat. Lab., Upton, NY, USA).

Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.54-5

The authors have studied the photoemission and photoabsorption (yield) of in situ sputtered amorphous Si films having various hydrogen content between 0 and 40%. These materials are of technological interest in the production of solar cells. Especially important are the behavior of the bandgap and possible states within the gap as a function of sample preparation (hydrogen content or annealing temperature). (2 refs.)

72968 The problem of cerium. D.Wieliczka (Iowa State Univ., Ames, IA, USA).

Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.56-7

In an attempt to understand the γ-α phase transition photoemission experiments were performed on both γ- and α-Ce. The samples were thick films evaporated in situ from high purity cerium. The γ-phase was produced by evaporating onto a room temperature substrate; the α-phase was formed by evaporating onto a substrate held at ~50K by a closed cycle helium refrigerator. The valence band spectra were measured at photon energies from $20\leq h\nu\leq170$ eV. (no refs.)

Proceedings of the XVIII All-Union Conference on Emission Electronics	See Entry 69775
The mechanism of the surface stabilization of $\mathrm{CrO_2}$ magnetic powders	See Entry 72190
Study of organic surfaces with UPS and metastable deexcitation spectroscopy	See Entry 72202
Orientation of water adsorbed on Cu(110)	See Entry 72234
Coadsorption of water and ions on Cu(110): models for the double layer	See Entry 72242
Interaction of $\mathrm{O_2}$ with low index faces of α-CuZn	See Entry 72248
XPS study of annealed $\mathrm{SiO_2}$/GaAs interfaces	See Entry 72253
Exchange banding of excited core states and its effects on core-level spectroscopies	See Entry 72299
Surface states of metastable $\mathrm{(GaAs)_{1-x}Ge_{2x}}$ alloys	See Entry 72464
Reflectance and UPS studies of band structures and final state interactions of low-spin pyrites	See Entry 72830
Metastable deexcitation spectroscopy and ultraviolet photoemission spectroscopy on electropolymerised polyacrylonitrile layer	See Entry 72835
XPS study for the oxidation and the induced segregation at the surface of stainless steels	See Entry 73243
An ESCA and Mossbauer study of the oxide layer formed on steel in water containing chromate and chloride ions	See Entry 73256

The reaction of sputtered FeTi with UHV residual gas studied by XPS .... See Entry 73370

Influence of aluminum adatoms on the germanium oxidation process .... See Entry 73371

79.70 FIELD EMISSION AND FIELD IONIZATION

72969 Explosive emission of metal points cooled to ultralow temperatures. V.M.Zhukov, M.S.Aksenov, G.N.Fursei, N.F.Fedorov.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.88-92 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1310-14 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
When some limiting current density is attained, field emission (FE) becomes explosive emission (EE). The authors' studies have employed points of tungsten (radii 0.2-0.4 μm) and niobium (radii 0.4-0.6 μm) with a rectangular voltage pulse width (τ_p) of 10, 20, and 150 nsec. A number of experiments were conducted using step-shaped voltage pulses. The procedure also provided for the possibility of creating a uniform magnetic field with a strength up to 4 kOe in the tip-anode gap. Microphotographs of tips, obtained with an electron microscope, were used to determine the quantity of material that was transported in the EE process. The relative error in measuring the mass amounted to 25%. (13 refs.)

72970 Some aspects of the control of the current of a high-brightness plasma emitter. V.A.Gruzdev, N.G.Rempe (Tomsk Inst. of Automatic Control Systems & Electronics, Tomsk, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.102-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1324-7 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
In plasma electron sources (PES), the emission current is usually controlled by varying the density, through adjustment of the discharge current used to generate the plasma in the PES. The brightness of the PES depends on the emission current and is usually not great at low current values. In principle, however, it is possible to have another method of control such that the emission current is varied by varying the area of the emitting surface of the plasma. To realize this possibility, the authors utilize the familiar procedure of limiting the emitting surface of the plasma in the PES emission channel by a layer of space charge between the plasma and the channel walls. Here it can be assumed that as the extent of the space-charge layer is varied while the discharge current (emission current density) is maintained constant, it is possible to regulate the emission current without substantially affecting the brightness or stability of PES operation. This method of emission-current control is effective in PES in which the extent of the space-charge layer is comparable to the dimensions of the emission channel. Such sources include, in particular, high-brightness PES based on a reflecting discharge in a magnetic field with a cold hollow cathode and extraction of electrons from the part of the discharge adjacent to the cathode, where the emitting surface of the plasma is confined by the ion layer of space charge in the region of the cathode potential drop. (5 refs.)

Adsorption of aluminum on low-resistance gallium arsenide .... See Entry 72221

Temperature programmed field desorption of protonated hydrogen from rhodium and tungsten .... See Entry 72238

Quantum size effect in electron transmission through Cu and Ag films on W(110) .... See Entry 72903

Screening of electric field and photosensitivity of InSb cathodes .... See Entry 72942

79.75 EXOELECTRON EMISSION

72971 Aspects of the formation of energy spectra of exoelectrons of thermally stimulated exoemission of dielectrics. V.S.Kortov, V.G.Isakov (Kirov Urals Polytech. Inst., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.175-80 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1401-6 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
By using an improved physical model and algorithm for the energy distribution of exoemission electrons, the authors have substantiated the anisotropic nature of TSEE of NaCl crystals with differing orientation of the planes, and also the fact that the parameters of the electron energy distribution depend on the excitation conditions of the crystal. The dependence of the TSEE on the emitter thickness, together with the obtained crystallographic anisotropy of its parameters, demonstrate that in a high vacuum the TSEE of dielectrics excited by electrons with energies of 1-3 keV is governed by bulk centers. (9 refs.)

72972 Hole-induced exoelectronic emission. B.A.Sorkin, V.V.Bichevin, H.F.Kaambre (Inst. of Phys., Acad. of Sci., Estonian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.181-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1407-11 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
By using a variety of experimental procedures, in particular the method of selective optical filling of the hole-capture or electron-capture level, the authors have demonstrated hole-induced exoelectronic emission (HI EEE) in a variety of alkali halides and oxides. It is most probable that HI EEE is effected via intercenter Auger processes, with the involvement (in addition to hole centers) of both two-electron and single-electron color centers. The predominance of the contribution of particular schemes of Auger processes to HI EEE depends greatly on both the particular emitter (in particular, doping impurities) and on the experimental conditions (particularly the preliminary excitation dose). (12 refs.)

Proceedings of the XVIII All-Union Conference on Emission Electronics .... See Entry 69775

Photostimulated exoemission from some organic compounds ... See Entry 72943

80.00 CROSS-DISCIPLINARY PHYSICS AND RELATED AREAS OF SCIENCE AND TECHNOLOGY

81.00 MATERIALS SCIENCE

72973 The influence of English terminology used in powder metallurgy on terms formation in the same field, expressed in other languages. S.M.Radic (Inst. of Tech. Sci., Serbian Acad. of Sci. & Arts, Beograd, Yugoslavia).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.637-40
Very close contacts between scientists, as well as frequent exchanges of information, have led to new ideas in a certain scientific field quickly circulating and spreading out; a lack of words describing such idea and terms in one language allows the foreign expressions to be accepted and used. In this century of scientific-technical revolution, it has been the English language that has had the most influence on other languages, as most discoveries and achievements have been formulated in it and most publications have been published in English. The influence of English terminology used in powder metallurgy on terms formation in the same field, expressed in other languages with particular review of the Slavonic languages, is presented. It has also been established there that certain English expressions and terms have acquired international meaning. (4 refs.)

Current topics in materials science. Vol.10 .... See Entry 69797

Graphitized carbon fibers: a new electrical conductor with high strength to weight properties .... See Entry 72371

81.10 METHODS OF CRYSTAL GROWTH AND PURIFICATION

(for physics of crystal growth, see 61.50C; for epitaxial growth methods, see 81.15)

72974 The crystal growth of refractory compounds. Y.Kumashiro (Electrotech. Lab., Ibaraki, Japan).
Oyo Buturi (Japan), vol.51, no.11, p.1262-8 (Nov. 1982). In Japanese. [received: March 1983]
The growing of crystals of the group IV and V transition metals and their carbon, nitrogen and boron compounds are discussed. Heating methods used are flux, diffusion, recrystallisation and laser along with more extreme methods including high frequency induction and plasma heating. The crystals produced using high frequency induction are evaluated. The problems associated with plasma heating are discussed. (48 refs.) *M.O.*

Material design .... See Entry 71916

What is a crystal growth unit? .... See Entry 71917

81.10B Growth from vapour

72975 Observation of defects in mercury cadmium telluride crystals grown by chemical vapor transport. E.A.Irene, E.Tierney (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), H.Wiedemeier, D.Chandra.
Appl. Phys. Lett. (USA), vol.42, no.8, p.710-12 (15 April 1983).
A mixture of nitric and hydrochloric acids was found to yield etch pits on mercury cadmium telluride crystals grown by chemical vapor transport using iodine or mercuric iodide as the transport agent. Two types of pits were observed by optical microscopy: triangular pyramidal and round saucer shaped pits. Transmission electron microscopy confirmed that two types of defects were present: dislocations and second phase occlusions. The present study suggests that the defects are near the crystal surface and therefore will probably not significantly affect the electrical characteristics. (8 refs.)

72976 Horizontal vapor transport process of $Pb_{1-x}Sn_xTe$ in a closed tube. Yuan Shi-xin, Xie Qin-xi, Si Cheng-cai, Yu Mei-fang (Shanghai Inst. of Tech. Phys., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.173-9 (Jan.-March 1983). [received: May 1983]
The horizontal vapor transport rate in a closed tube loaded with $Pb_{1-x}Sn_xTe$ can be rapidly measured by a balance method. The effects of the residual gases, such as oxygen, nitrogen, excessive tellurium, and lead on the transport rate are studied. It is shown that in the transport process of sublimate type materials, no saturation appears when the temperature difference is lower than 30°C. The transport equation of the sublimate type is established; the calculated results are compared with the experimental data. According to the data of the transport rate, calculation can be made showing that the interdiffusion coefficient between N_2 and $Pb_{1-x}Sn_xTe$ is 0.013 cm^2/sec. (15 refs.)

72977 The chemical transport of scandium(III)-fluoride by means of silicon tetrachloride and germanium tetrachloride. W.Redlich, T.Petzel (Inst. fur Werkstofftech., Hochschule der Bundeswehr Hamburg, Hamburg, Germany).
Rev. Chim. Miner. (France), vol.20, no.1, p.54-9 (1983). In German.
It is shown that ScF_3 can be chemically transported in a temperature gradient (e.g.: $900°C \rightarrow 850°C$) by means of $SiCl_4(g)$ and $GeCl_4(g)$ in closed quartz ampoules. The transported material is deposited in well-shaped, transparent, colorless single crystals (cubic, space group $Pm3m$, $a = 4.0127 \pm 0.0016$ Å). Observed and calculated transport rates are critically compared considering the following possibly important transport reactions:
$ScF_3(s) + 0.75MCl_4(g) \leftrightharpoons ScCl_3(g) + 0.75MF_4(g)$,
$2ScF_3(s) + 1.5MCl_4(g) \leftrightharpoons Sc_2Cl_6(g) + 1.5\ MF_4(g)$(M=Si, Ge). (20 refs.)

81.10D Growth from solutions

72978 Lattice disorder and electrical conductivity of flux-grown $Ca(WO_4)_x(MoO_4)_{1-x}$ crystals. S.K.Arora, R.S.Godbole, D.Lakshminarayana (Dept. of Phys., Sardar Patel Univ., Gujarat, India).
J. Mater. Sci. (GB), vol.18, no.5, p.1359-64 (May 1983).
The growth of solid solutions of $Ca(WO_4)_x(MoO_4)_{1-x}$ in the range $x = 0.072$ to 0.86 has been successfully accomplished for the first time, employing a flux technique. The fact that proper mixing occurs is established by observing the variation in unit cell parameters and density of the crystals. The electrical conductivity of the pelletized samples is interpreted in terms of Schottky and

Frenkel defect concentrations. The role of oxygen ion vacancies is stressed for the intrinsic region of conductivity. (16 refs.)

72979 Crystal growth of refractory compounds from solutions in metallic melts. V.N.Gurin, M.M.Korsukova (A.F. Ioffe Phys.-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.1, p.59-101 (1983).
The authors present and illustrate the fundamentals of crystal growth of refractory compounds by the solution method. Single crystals of refractory compounds prepared by the solution method have recently been employed for electronic applications. (175 refs.)

72980 Preparation and properties of SmB_6 and SmB_4 single crystals. S.Okada, T.Atoda (Dept. of Appl. Chem., Kanagawa Univ., Yokohama-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.3, p.137-47 (1983). In Japanese.
The preparation of single crystals of SmB_6 (cubic system) and SmB_4 (tetragonal system) using molten aluminum flux method in an argon atmosphere has been investigated. As-grown SmB_6 and SmB_4 single crystals were both used for measurements of lattice constant, density and Knoop-microhardness, and also for the study of oxidation reaction and kinetics in air at temperature range between 700°C and 1250°C and time between 10 and 120 min. (29 refs.)

Optical properties of KDP and DKDP crystals grown at high rates ....See Entry 72759

81.10F Growth from melts

72981 Temperature fields in apparatus for growing leucosapphire single crystals by using mathematical modeling. Yu.K.Lingart, Ya.I.Shtipel'man (All-Union Sci.-Res. Planning, Design & Technol. Inst. of Electrothermal Equipment, Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.936-43 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.306-14 (Aug. 1982). [received: April 1983]
An approximate mathematical model and methodology for designing a horizontal directional crystallization (HDC) apparatus are proposed. The results of computations are compared with experimental data. (11 refs.)

72982 Growth of dislocation-free bulk silicon crystals. R.K.Bagai, W.N.Borle (Solid State Phys. Lab., Delhi, India).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.1, p.25-46 (1983).
This review discusses (a) various known methods for the growth of silicon crystals from the melt and (b) the mechanisms of the formation and the techniques for the elimination of dislocations during growth. (81 refs.)

72983 Silicon sheet technologies. T.F.Ciszek (Solar Energy Res. Inst., Golden, CO, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.316-26
A classification of silicon sheet growth methods by meniscus geometry permits them to be discussed in three groups: short meniscus techniques, high meniscus techniques, and extended meniscus or large solid/liquid interface area techniques. A second parameter, meniscus shaper interaction with the liquid silicon, is also instrumental in determining the characteristics of the various sheet processes. The current status of each process is discussed in the context of meniscus geometry and shaper/melt interaction. One aspect of sheet growth, surface area generation rate, is quantitatively compared with combined ingot growth and wafering surface area generation rates. (43 refs.)

72984 Crystal defect problems. G.H.Schwuttke.
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.327-32
A minority carrier lifetime evaluation of 100 mm Czochralski silicon wafers is presented. The evaluation uses wafers as available from major vendors in the world. It relies on minority carrier lifetime mapping of the total wafer area. Main results include local variations of lifetime on a wafer of several orders of magnitude and uncontrollable degradation during hot processing. A similar evaluation of silicon web dendrite shows significant uniform improvement of lifetime over large web areas. The results are related to the defect structures present in both crystal types. (4 refs.)

72985 Advances in the automation of the Czochralski process for silicon crystals. H.Birck (Leybold-Heraeus GmbH, Hanau, Germany).
Semiconductor International '82, England, 1982 (Luton, Beds., England: Benn Electronics Publications 1982), p.25-8
By employing computers and suitable cameras as optical measuring systems it is now possible to automate the pull process completely, especially melting of even large silicon masses, stabilizing of the melt temperature, dipping of the seed into the melt, pulling of neck, shoulder and tail. Applying new pulling technologies such as periodical speed/time functions for the crucible rotation or pulling with varying melt levels are made easy by using a computer. Interfacing of a camera system to a computer allows retrieving of a lot of different data during various process states. Perspective image defects in measuring the crystal diameter can be corrected by the computer by applying the optical projection laws. The result is an accurate diameter measuring system for a wide range of distances between camera and crystal. Online and offline diagnostic routines and test run capabilities of the software ease the maintenance and increase the availability of such highly automated tools, enhancing even more the advances which could be reached by computerizing Czochralski pullers. (no refs.)

Convection in melt growth—theory and experiments ....See Entry 71915

Growth kinetic limitations during rapid solidification ....See Entry 72088

Defect analysis of RTR ribbons ....See Entry 73455

81.10H Zone melting and zone refining

72986 Temperature gradient zone melting. V.N.Lozovskii, V.P.Popov (Novocherkassk Polytech. Inst., Rostov Region, USSR).
Prog. Cryst. Growth & Charact. (GB), vol.6, no.1, p.1-23 (1983).
Presents the main regularities of temperature gradient zone melting (TGZM). Theoretical and experimental studies of kinetics and stability of the process and the redistribution of impurities and the main components of solid solutions in TGZM are reviewed. Special attention is paid to the application of the method to growing perfect crystals, epitaxial layers of semiconductors, electrically heterogeneous structures; as well as to physico-chemical investigations. (52 refs.)

Theoretical analysis of heat transfer in zone-melting operation ....See Entry 71555

Transient thermal Marangoni convection in a liquid bridge [floating zone techniques, near zero gravity] ....See Entry 71557

Irradiated solar cells fabricated from gallium-doped/boron-doped FZ and CZ silicon ....See Entry 73443

81.10J Growth from solid phases

(inc. multiphase diffusion and recrystallisation)

Suppressing Al outdiffusion in implantation amorphized and recrystallized silicon on sapphire films ....See Entry 71985

Argon implantation in GaAs: damage and lattice site location analyses ....See Entry 71992

Amorphization of germanium, gallium phosphide, and gallium arsenide by laser quenching from the melt ....See Entry 72006

81.15 METHODS OF THIN FILM DEPOSITION

(inc. epitaxial growth methods; see also 68.55 Thin film growth, structure, and epitaxy)

72987 Formation of metastable monoclinic rare earth sesquioxides from the melt. R.McPherson (Dept. of Materials Engng., Monash Univ., Clayton, Victoria, Australia).
J. Mater. Sci. (GB), vol.18, no.5, p.1341-5 (May 1983).
A number of rare earth sesquioxides prepared by rapid cooling of the melt, by plasma spraying onto a cold substrate, consist entirely of the metastable monoclinic (B) form or a mixture of B and the cubic (C) form which is stable at room temperature. This may be explained by suppression of the B to C transformation for Sm_2O_3, Eu_2O_3, Tb_2O_3 but the B-form is metastable at all temperatures for Y_2O_3, Er_2O_3 and Yb_2O_3 and its appearance in these oxides is thus related to the nucleation kinetics of B and C from the melt. (13 refs.)

Plasma technologies for powder particles ....See Entry 71802

Analysis of conditions for powder surface deposition by laser ....See Entry 73236

Formation of the contact zone between a detonation-deposited coating and a basis material ....See Entry 73278

81.15C Deposition by cathodic sputtering

72988 Blue sputtered iridium oxide films (blue SIROFs). K.S.Kang, J.L.Shay (Bell Labs., Holmdel, NJ, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.766-9 (April 1983).
Reports on the preparation and properties of 'blue' sputtered iridium oxide films (blue SIROF) and compare their properties with those of previous 'black' SIROFs as well as anodically grown iridium oxide films (AIROFs). Blue SIROFs are prepared by reactive DC sputtering of iridium in argon/oxygen, 80/20 mixture, at deposition rates of about 200 Å/min onto substrates held at 238K. The physical properties of blue SIROF show characteristics similar to AIROFs. In contrast to SIROFs previously deposited in pure oxygen onto substrates held at 289K, the new films have an optical absorption spectrum which peaks at 610 nm. The cyclic voltammograms, the magnitude of the electronic conductivity change, and their density are closer to those of AIROFs than previous SIROFs. As electrochemical display electrodes, the blue SIROFs have an improved open-circuit bleached state and written-state memory, as well as an improved appearance. (22 refs.)

72989 Substrate heater and biasing electrode assembly for RF sputtering unit. C.A.Stone, A.Rozaj-Brvar, R.F.Davis (Materials Engng. Dept., North Carolina State Univ., Raleigh, NC, USA).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.633-5 (May 1983).
Heating and biasing of a thin film during deposition is frequently desirable to improve the structural quality of the film and to remove entrapped gases and losely bound species on the surface. A large-diameter electrode assembly which allows both operations to occur simultaneously with a resulting variation of film thickness across a 2.54-cm wafer of ≤ 0.1 μm is described. (10 refs.)

72990 Design and operation of a high efficiency magnetron sputter coater. C.E.Nockolds, K.Moran, E.Dobson, A.Phillips (Electron Microscope Unit, Univ. of Sydney, Sydney, NSW, Australia).
Scanning Electron Microsc. (USA), pt.3, p.907-15 (1982).
A planar magnetron sputter coater has been developed for preparing specimens of examination in the SEM. The high ionizing efficiency of the coater is obtained by the use of an annular magnetic system which traps the high energy electrons in a ring close to the surface of the cathode. The increased interaction between the electrons and the gas atoms leads to fast coating rates, and allows a discharge to be maintained down to a vacuum level of approximately 0.05 Pa. The performance of the coater has been studied in terms of coating rate and heating rate as a function of vacuum. For Au coating at 0.1 Pa and a cathode to specimen distance of 50 mm the coating rate is 0.9 nm/sec and the temperature rise in the specimen is 0.15 K/sec. Au, Pt, Au/Pd and Ag films have been prepared at three different gas pressures (10, 1 and 0.1 Pa). The 10 Pa Au, Au/Pd and Pt films show severe cracking, but at 1 and 0.1 Pa, continuous films are formed. The Au/Pd and Pt films are finer grained than the Au and Ag films. The Au and Ag films become more coarse grained as the gas pressure is reduced. W and Ta films prepared at 0.1 Pa are very smooth and fine grained. (21 refs.)

72991 High rate sputtering technique using a hollow type target. H.Yamamoto, M.Tanaka (Coll. of Sci. & Technol., Nihon Univ., Funabashi, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.2, p.167-8 (Feb. 1983). In Japanese.
A new technique for a high rate sputtering deposition was demonstrated. Hollow type targets of Nb and W were sputtered. A sputtering power density up to about 25 W/cm^2 was attained at which an optimum deposition rate of about 1000 Å/min was observed for a tungsten target. (2 refs.)

Properties of sputtered molybdenum silicide thin films ....See Entry 72259

Metastable BCC phase in sputtered Fe-Ni alloys ....See Entry 72276

Superconducting properties of metallic heterostructures ....See Entry 72554

Electro-optic effects of (Pb, La)(Zr, Ti)O_3 thin films prepared by RF planar magnetron sputtering ....See Entry 72770

An overview of ion sputtering physics and practical implications ....See Entry 72916

81.15G Vacuum deposition

72992 Growth of single crystal epitaxial silicides on silicon by the use of template layers. R.T.Tung, J.M.Gibson, J.M.Poate (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.10, p.888-90 (15 May 1983).
A novel crystal growth technique for silicide epitaxy is presented which utilizes thin silicide (>60 Å) template layers to pin the subsequent growth under ultrahigh vacuum conditions. Single crystal $NiSi_2$ films can be grown with either type A or type B orientations on Si(111). Continuous single crystal $NiSi_2$ is grown on Si(100) with a flat interface and uniform thickness. Thick $CoSi_2$ can be grown on Si(111) by a similar process using thicker templates. (10 refs.)

72993 How to place a Knudsen source to obtain optimal uniformity of film thickness on a spherical substrate holder. P.P.Elekes (Phys. Inst., Tech. Univ., Budapest, Hungary).
Vacuum (GB), vol.33, no.1-2, p.19-23 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Knudsen sources are placed in an offset position on the surface of the same sphere on which the substrates are located. Geometric positions for uniform film thicknesses are shown, i.e. favourable places for locating a thickness monitor. It is demonstrated that if the sphere rotates on its diameter parallel to the axis of symmetry of the Knudsen source with constant angular speed the film thickness at any point on the surface of the sphere (over the source) is identical after each complete turn. This leads to a simple relation between film thickness and quantity of material evaporated. Some considerations are given to the design of planetary systems. (3 refs.)

1.5-1.6-μm $Ga_{0.47}In_{0.53}As/Al_{0.48}In_{0.52}As$ multiquantum well lasers grown by molecular beam epitaxy .... See Entry 71118

Structure of stabilised ZrO_2 vacuum condensates .... See Entry 72257

Column structure of dielectric evaporated layers and some of their properties .... See Entry 72260

Growth of a metal island film under conditions of non-steady-state reevaporation of metal adatoms .... See Entry 72262

The future of molecular beam epitaxy .... See Entry 72268

High resolution transmission electron microscopy investigation of adsorption and growth of Au on ZnTe surfaces .... See Entry 72274

Mechanism of coalescence of metal particles on a substrate .... See Entry 72275

Effects of co-depositing oxygen on the growth morphology of (111) and (100) Al single crystal faces in thin films .... See Entry 72278

Investigation of metal evaporation by mass spectrometry .... See Entry 72279

Microstructure and electro-optical properties of evaporated indium-oxide films .... See Entry 72522

Special features of photoluminescence of GaAs films produced by molecular-beam epitaxy .... See Entry 72848

81.15H Chemical vapour deposition

72994 Thermodynamic optimisation in CVD processes involving candidate materials for photovoltaic solar energy conversion and for space applications. C.Bernard (Lab. de Thermodynamique et Phys.-Chimie Metall., Domaine Univ., St. Martin d'Heres, France).
High Temp.-High Pressures (GB), vol.14, no.4, p.377-81 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).
Three example applications of chemical vapour deposition (CVD) techniques that have recently become important in areas of current technological interest are given to show how detailed thermodynamic analysis of the deposition equilibria can be used to aid optimisation of the processes. The processes examined are: in-depth deposition of SiC in porous carbon-carbon materials; low-pressure GaAs vapour-phase epitaxy in the chloride system; and growth of AlSb on insulating substrates from organometallic gaseous species. (13 refs.)

72995 Influence of impurities on lateral polysilicon pn diodes. M.Dutoit (Centre Electronique Horloger SA, Neuchatel, Switzerland).
J. Electrochem. Soc. (USA), vol.130, no.4, p.967-8 (April 1983).
Shows that gaseous pollutants, which may inadvertently be present in the LPCVD reactor during deposition, can significantly alter the properties of polysilicon diodes. The impurities most likely to be found are H_2, O_2, and HCl. H_2 is a byproduct of the pyrolysis of SiH_4; O_2 may be introduced by leaks or be absorbed on the walls of the tube while the reactor is opened to room ambient, and HCl is used before each deposition to clear the wafers. (12 refs.)

72996 Silicon-germanium alloy growth control and characterization. L.I.Halberg, J.H.Nevin (Dept. of Electrical & Computer Engng., Univ. of Cincinnati, Cincinnati, OH, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.779-93 (July 1982). [received: Nov. 1982]
Silicon-germanium alloy has been grown on silicon substrates by the hydrogen reduction of silicon tetrachloride and germanium tetrachloride as well as the pyrolysis of silane and germane. The film growth characteristics in the first few minutes have been studied using an SEM. Techniques have been developed for growing high germanium content films which are single crystal and have surface suitable for MOS device fabrication. (7 refs.)

72997 Study of the temperature field in a vertical cold wall reactor by holographic interferometry [CVD]. S.Benet, R.Berge, S.Brunet, S.Charar (Lab. de Phys. Appl. Univ. de Perpignan, Perpignan, France), B.Armas, C.Combescure.
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.2, p.77-88 (1982).
The study of the temperature field in a cold wall reactor was carried out using an interferometric method. The introduction of holographic techniques makes it possible to realise an interferometer presenting many advantages as compared to the classical Mach-Zehnder apparatus. The interferograms may be obtained either by the double exposure method or by that of the reference hologram allowing real time investigations, the latter being particularly interesting for time dependent phenomena. Quantitative processing is carried out on finite fringe interferograms so as to increase the measurement accuracy. (13 refs.)

72998 Recrystallization of amorphous and small grain size polycrystalline silicon. W.J.J.Schins, J.Bezemer, C.D.Ouwens, S.Radelaar.
Report EUR 8197 EN, Comm. European Communities, Luxembourg (1982), 43 pp. Contract 444-78-4 ESN.
Layers of polysilicon were grown by CVD on graphite. The positive influence of dopants (Al and B) on the high temperature recrystallisation and grain growth was investigated. A systematic study of recrystallisation of hot-deformed single and polycrystalline silicon was carried out. New grains are formed by nucleation and growth at temperatures between 1280 and 1410°C and the final grain size is a function of the degree of deformation. Experimental p-n junction solar cells on various substrates show that CVD grown cells on polycrystalline material are of good quality. A high concentration of Al in the substrates is not detrimental to the efficiency. Application of the proposed method on a large scale would require recrystallisation of thin layers (10-50 μm) of silicon on graphite. (9 refs.)

Technical and economic aspects of the different fibre fabrication processes .... See Entry 71234

Preparation of germanate glass by vapor-phase axial deposition .... See Entry 71259

Vapor phase epitaxial growth of ZnSe films .... See Entry 72263

The effect of a continuous etch on the growth rate and morphology of InP prepared by the vapour phase epitaxial-hydride method .... See Entry 72264

Growth and characterization of Si doped vapor phase epitaxial GaAs for MESFET .... See Entry 72265

Surface reaction of GaAs vapour phase epitaxy .... See Entry 72266

An infrared absorption study of LTCVD silicon dioxide .... See Entry 72786

Nouvelles methodes de preparation de materiau semi-conducteur cellules solaires Cu_2S-CdS (New methods for the production of the solar cell semiconductor material Cu_2S-CdS) .... See Entry 73439

81.15J Ion plating and other vapour deposition

72999 Future prospects for application of ion deposition of thin films in microelectronics. V.P.Belevskii, I.V.Gusev.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.2, p.51-8 (1982). In Russian.
An analysis is made of the current state of the methods and conditions for producing thin films using numerous previously published articles and original results. Using as an example two high-precision processes (silicon autoepitaxy and the production of superconducting niobium films), a study is made of the interrelation of the parameters being monitored—the residual gas pressure, the condensation rate, the substrate pre-heating temperature, the ion energy and the correlation between the ionised and neutral components in the vapour flow onto the substrate. Diagrams illustrating these interrelations are given and it is shown that the bombardment of the film surface during growth with ions of the material being deposited causes a sharp reduction in the threshold of the sensitivity of the process to the residual gas pressure, substrate preheating temperature and other 'instrumental' factors which are hard to monitor. The ion deposition method is found to offer good prospects for the industrial production of thin layers with a perfect structure and acceptable electrophysical characteristics. (51 refs.) *L.M.H.*

73000 An optical emission study of the glow-discharge deposition of hydrogenated amorphous silicon from argon-silane mixtures. F.J.Kampas (Div. of Metall. & Materials Sci., Brookhaven Nat. Lab., Upton, NY, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2276-80 (May 1983).
Optical emission intensities from atomic silicon and argon and molecular hydrogen have been measured in silane-argon mixture glow discharges as a function of silane percentage and RF voltage. These measurements show that the electron concentration decreases and the average electron energy increases as the silane concentration increases. This dependence explains why the deposition rate of hydrogenated amorphous silicon from silane-noble gas mixtures is not proportional to the silane concentration. (23 refs.)

73001 Electron accelerated plasma for ion plating of refractory metal. J.Uramoto (Inst. of Plasma Phys., Nagoya Univ., Nagoyashi, Japan).
J. Vac. Soc. Jpn. (Japan), vol.26, no.1, p.15-21 (1983). In Japanese.
Discharge plasmas and electron beams for ion plating of refractory metals (especially, tungsten W) are researched. Two necessary conditions are required: a power concentration above 10 kW to hearth and a plasma production above a density of 10^{11}/cc around the center of the plasma or the beam. A high energy electron beam (>10 keV) with a space charge limit (~1A) can satisfy the power concentration, but the produced plasma density is too low because the ionization rate is very small. A low voltage discharge in a gas can produce a plasma source with a sufficient density, but the power concentration to hearth is not effective (only about 1/4 of total discharge power). Therefore, the large discharge current (>1000A) is required while the power loss and the discharge cathode emission become serious. To satisfy the two necessary conditions for ion plating of W, the authors propose to use an electron accelerated plasma in which the electrons are accelerated locally along a magnetic field, and have an energy of a few hundred electron volt and a current of several tens ampere. (17 refs.)

73002 Annealing effects in a-Si:H thin films prepared by glow discharge method. H.Kakinuma, S.Nishikawa, T.Iwabuchi, T.Watanabe, K.Kaminishi (Res. Lab., Oki Electric Industry Ltd., Tokyo, Japan).
J. Vac. Soc. Jpn. (Japan), vol.26, no.1, p.35-44 (1983). In Japanese.
Annealing effects on photoconductive, morphologic, and IR absorptional properties of glow discharge a-Si:H films are investigated. Samples are decomposited with pure silane changing two decomposition parameters, growth rate and substrate temperature (T_s). Photoconductivity (σ_p) of low T_s samples is extremely low but steeply increases by ~3 orders at certain T_s as T_s is raised, and the turning T_s depends on the growth rate. The σ_p of the low T_s samples increases by 1~2 orders with annealing up to ~250°C. This large change corresponds to the disappearance of the grain boundary observed by TEM. Dark conductivity (σ_d) at room temperature shows various transport mechanisms depending on the deposition conditions. Localized states density at E_f estimated from γ ($\sigma_p \propto F^{\gamma}$, F: intensity) decreases as T_s is raised or annealed up to 150~250°C. These results are discussed in some detail. (17 refs.)

73003 An investigation of microcrystalline films produced by a DC glow discharge in silane and hydrogen. D.E.Carlson, R.W.Smith (RCA Labs., Princeton, NJ, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.749-60 (July 1982). [received: Nov. 1982]
Microcrystalline and amorphous Si:H films have been produced in a DC cathodic discharge in atmospheres containing silane dilute in hydrogen. The composition of the discharge atmosphere has a strong effect on the nucleation of microcrystalline Si:H films. Dopants such as boron enhance the formation of microcrystals while higher silanes such as disilane inhibit crystallization. The presence of other gases in the discharge atmosphere generally inhibits the formation of microcrystals. (12 refs.)

Collision of a low-temperature laser plasma with a condensed medium ....See Entry 72256

Nickel base metallic glass powders for application as plasma sprayed coatings ....See Entry 73032

81.15L Deposition from liquid phases (melts and solutions)

73004 The growth of Cu_2S on polished or etched single crystal CdS substrates [for photovoltaic cells]. G.J.Russell, S.Oktik, J.Woods (Dept. of Appl. Phys. & Electronics, Univ. of Durham, Durham, England).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.229-32 (May 1983).
The authors report a study of the growth rates of Cu_2S on planes of both etched and mechanically polished surfaces of single crystal CdS. By using a SEM, it has been possible to extend the measurement to thinner layers which are comparable with those actually used in the preparation of photovoltaic cells. (18 refs.)

73005 Electrochemical nucleation and growth of silicon in molten fluorides. K.L.Carleton, J.M.Olson, A.Kibbler (Solar Energy Res. Inst., Golden, CO, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.782-6 (April 1983).
The electrochemical nucleation and growth of silicon on vitreous carbon and graphite are characterized. The anode is a copper:silicon alloy and the electrolyte is a molten solution of $KF:LiF:K_2SiF_6$ at 750°C. SEM examination of the initial stages of electrodeposition shows that the nucleation process is instantaneous and is followed by three dimensional growth. Because the nucleation is instantaneous, the initial nucleation density and the grain size of the deposited silicon can be controlled. Existing theoretical models for nucleation and their failure to model this system are also discussed. (14 refs.)

73006 A study on electroless plating of cobalt alloy films for perpendicular recording. T.Osaka, N.Kasai, I.Koiwa (Dept. of Appl. Chem., Waseda Univ., Okubo, Shinjuku-ku, Tokyo, Japan), F.Goto.
J. Electrochem. Soc. (USA), vol.130, no.4, p.790-4 (April 1983).
An electroless plating bath for the preparation of perpendicular recording media was developed. It was found that the HCP structure of Co-P is oriented normal to the film plane with the Mn codeposition into the films. First, an ammoniacal malonate-malate bath, containing $MnSO_4$ was selected. Nickel was codeposited into the films in order to decrease the saturation magnetization, *Ms* since low *Ms* is necessary to decrease the demagnetizing field. Second, effects were investigated for three factors (i.e. $MnSO_4$ concentration, bath *p*H and $NiSO_4$ concentration) causing the c-axis perpendicular orientation of the film properties. Optimum plating conditions for perpendicular recording media were thus determined. (17 refs.)

73007 The effect of some additives on electroless copper deposition. M.Paunovic, R.Arndt (PCK Technol. Div., Kollmorgen Corp., Melville, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.794-9 (April 1983).
The effect of adenine, guanine, saccharin, and coumarin on electroless copper deposition has been studied by cyclic voltammetry and the weight gain method. It was found that guanine and adenine accelerate electroless copper deposition. Coumarin and Saccharin have almost no effect on the deposition process. Differences in the effect of these two groups of additives have been correlated to differences in the electronic structure of molecules. (31 refs.)

73008 Electrodeposition of conducting transition metal oxide/hydroxide films from aqueous solution. D.Tench, L.F.Warren (Microelectronics Res. & Dev. Center, Rockwell Internat., Thousand Oaks, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.869-72 (April 1983).
Reports results describing a general technique for the electrochemical deposition of oxide/hydroxide films of copper, nickel, cobalt, iron, and manganese from aqueous solution. The general properties of these materials, some of which are new, are also discussed. (11 refs.)

73009 Tin(IV)-based photoselective metal deposition of cobalt and nickel from alkaline baths. I.Kiflawi (Precision Electronic Components Ltd., Toronto, Ontario, Canada), M.Schlesinger.
J. Electrochem. Soc. (USA), vol.130, no.4, p.872-4 (April 1983).
First the authors report that the production of a negative photoimage using alkaline nickel or cobalt metallizing baths is possible. Then they attempt to further clarify possible mechanisms for the influence of ultraviolet irradiation on subsequent metal deposition. (7 refs.)

73010 The effect of pH on electroless copper deposition. J.Duffy, L.Pearson, M.Paunovic (PCK Technol. Div., Kollmorgen Corp., Melville, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.876-80 (April 1983).
Electroless copper deposition is affected by pH. In order to formulate theory of the rate vs. pH function, the authors have selected two approaches: electrochemical and spectroscopic. In the electrochemical approach, they have investigated the effect of pH on the rest potentials and the transfer coefficients for partial processes composing electroless copper deposition. In the spectroscopic approach they have investigated the effects of pH on the composition of the adsorption film on the substrate. The importance of these studies is twofold: to elucidate the dependence of the rate of electroless copper deposition on *p*H and to interpret the dependence of the effect of additives on pH (13-16). The accelerating effect of an additive is usually observed in the range of the peak in the rate vs. pH function. The inhibiting effect of the same additive is observed at the lower and the higher pH values. For these reasons, Auger spectra have been taken for three characteristic values around the maximum. (32 refs.)

73011 Optimum conditions for baking of indium. M.Janson (Inst. of Microwave Technol., Stockholm, Sweden).
J. Electrochem. Soc. (USA), vol.130, no.4, p.960-2 (April 1983).
Calculations of SiO partial pressure over an indium melt with dissolved silicon in a moist hydrogen atmosphere are reported. The results are given as a function of temperature, water vapor pressure, and concentration of silicon in the melt, both with and without SiO_2 present. The influence of the total pressure in the baking system is considered, and the calculations indicate that by using a pressure lower than atmospheric, the efficiency of the baking should be significantly increased. The time constant of the baking process is, furthermore, shown to be critically dependent on water vapor partial pressure. These results should be valuable when one wants to find the optimum baking procedure to remove residual silicon from indium. (9 refs.)

73012 The colour of gold and gold alloy electrodeposits. D.J.Arrowsmith (Dept. of Metall. & Materials Engng., Univ. of Aston, Birmingham, England), G.Brown.
Trans. Inst. Met. Finish. (GB), vol.61, pt.1, p.1-8 (Spring 1983).
The thickness of gold required to cover the colour of the substrate has been determined and found to be 0.23 μm for a matt gold deposit on a substrate prepared to 600 grit and 0.06 μm for a bright gold deposit on a surface prepared to a 6 μm diamond finish. A general method of defining covering power is proposed. The change in colour from additions of copper and silver to a gold bath was monitored by a spectrophotometric technique. As the silver content of the bath was increased there was a smooth transition of colour from yellow through green to white; the smoothness of the transition is ascribed to the structural homogeneity of the gold-silver system. The addition of copper gives an undulating effect on the colour change which is thought to be due to the presence of long range order in the gold-copper system exemplified by the formation of superlattices based on CuAu and Cu_3Au. (6 refs.)

73013 A new high performance sodium chloride acid zinc plating process. R.J.Lash (Udylite/Sel-Rex, Warren, MI, USA).
Trans. Inst. Met. Finish. (GB), vol.61, pt.1, p.25-9 (Spring 1983).
An acid zinc plating process which uses a sodium chloride supporting electrolyte is now practical. Cathodic depolarisation caused by the smaller sodium ion in the electric double layer can have a detrimental effect on the performance of conventional potassium chloride acid zinc brighteners. This problem is overcome with the use of special brighteners which are apparently stronger cathode inhibitors. (19 refs.)

73014 Electrodeposition of silver alloy powders on rotating and vibrating cathodes. A.T.Kuhn (Inst. of Dental Surgery, Eastman Dental Hospital, London, England), P.Neufeld, D.W.Cruickshanks-Boyd.
Trans. Inst. Met. Finish. (GB), vol.61, pt.1, p.30-4 (Spring 1983).
A detailed study of the manufacture of Ag-Sn and Ag-Sn-Cu powder deposits at rotating cylinder and vibrating cathodes is reported. The electrolyte used was a cyanide-stannate bath. The effects of cathode potential, mass transport (rotation rate of cylinder) and temperature were examined, as well as use of K^+ in place of Na^+ cations. It is shown that the silver deposition process is mass transport controlled, the tin activation controlled. There is no evidence to suggest that the various components of the bath interact with one another. The full range of Ag-Sn compositions can be formed as powders, and it appears that Cu in any proportion can be included in these powders. Powders having the composition of commercially available dental amalgam alloys (Ag-28% Sn, O-30% Cu) were prepared. (19 refs.)

73015 Some mechanical and electrochemical properties of electroless nickel. A.J.Gould.
Univ. Nottingham, England thesis, 1982
Experiments have demonstrated that the temperature and pH of the plating bath had a significant effect upon the deposit's composition as well as the mixed electrode potential of the plating process. Maintaining a constant potential, close to that of the mixed electrode potential, with a potentiostat, significantly reduced the increase in phosphorous content (0.8 wt.% P compared to 2.1 wt.% P) experienced during plating. The cathodic polarisation of the plating system improved the plating rate whilst not affecting the composition. Therefore the additional electrolyte processes, despite being two electron processes, co-deposited nickel and phosphorous. The electroless nickel deposit, plated by the potentiostatic technique, improved the fretting wear resistance of the EN25 substrate provided that it was at least 25 μm thick. Heat treatment of the coating in the range 200-400°C improved the wear resistance for all coating thicknesses tested. Raising the temperature of the fretting tests to 350°C increased the wear rate but at 600°C a protective oxide film or glaze was formed which provided good wear resistance. Serious reductions in the fatigue strength of the EN25 were produced by the coating in the as-deposited (20%) and heat treated at 400°C to maximum hardness (45%) conditions. The conjoint action of fretting and fatigue further reduced the fatigue strength by 53% and 70% respectively.

73016 Depot de couches polycristallines de silicium sur un substrat conducteur a partir de la phase liquide (Deposition of polycrystalline Si films on conducting substrates from the liquid phase). C.Belouet.
Report EUR 8305 FR, Comm. European Communities, Luxembourg (1983), 84 pp. In French. Contract 749-78-7/ESF.
Reports on the results of a one-year study of the growth of polysilicon layers on a carbon substrate by the RAD (ribbon against drop) process. The new pulling equipment, the characteristics of the ribbon substrates and the morphological and electrical properties of the layers are successively described. Deposition lengths up to 80 cm have been achieved at pulling rates 2 to 6 cm/mn on typical substrates (Papyex coated by pyrocarbon deposited at 2000°C). Elastic and thermal properties of the ribbon substrates have been investigated and a preliminary study of the strains in the multilayer Si-substrate is presented. The anisotropy of the reactivity of pyrocarbon with molten silicon is evidenced. Finally, the feasibility of Si-substrates ohmic contacts is demonstrated. On the basis of all the results accumulated, it is concluded that AM1 conversion efficiencies of 10% can be achieved for n^+/p homojunction cells.

Growth and characterization of Cd-doped InGaAsP/InP double heterostructure lasers ....See Entry 71125

Reduction of dislocations in LPE layers due to the action of thermal stresses ..
....See Entry 71961

Surface defects of closed-system-grown $Cd_xHg_{1-x}Te$ epitaxial layers ....
....See Entry 72269

Isothermal liquid phase epitaxy ....See Entry 72273

Diataxy (graphoepitaxy) and other approaches to oriented crystallization on amorphous substrates ....See Entry 72283

High mobility in liquid phase epitaxial InGaAsP free of composition modulations ....See Entry 72521

Temperature gradient zone melting ....See Entry 72986

Stability of film casting of power-law liquids ....See Entry 73060

Pretreatment of galvanized surfaces prior to powder coating ...See Entry 73279

81.20 OTHER METHODS OF PREPARATION OF MATERIALS

81.20E Powder techniques, compaction and sintering

73017 Sintering of porous glass. T.H.Elmer (Corning Glass Works, Corning, NY, USA).
Am. Ceram. Soc. Bull. (USA), vol.62, no.4, p.513-16 (April 1983).
The sintering of porous glass was monitored by measuring changes in length, surface area, pore size, weight loss, and moisture adsorption capacity of porous specimens after various stages of heating. Shrinkage was minimal up to ≈800°C. But above 900°C, where viscous flow becomes significant, the sintering rate increased dramatically. Reactions involving boron, water, and siloxane bridges are postulated during the consolidation of the porous structure into an impervious, clear glass. (25 refs.)

73018 Macromechanism of powder deformation in the incoherent zone during rolling. O.A.Katrus (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).

Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.683-8 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.1-7 (Sept. 1982). [received: March 1983]

It is concluded that observation of the deformation of a free-flowing material through transparent hopper walls is a technique yielding a great deal of useful information and enabling the deformation behavior of powders to be studied in the lag zone (breaks in the velocity field, formation of arch structures, and the like). A binding link between the geometric and physical parameters of the powder rolling process is the initial powder compressibility. An increase in the intensity of the shear deformation of powders before the commencement of their irreversible densification suggests that impeded deformation zones may not be able to form above the angle of rolling. (12 refs.)

73019 Kinematics of powder being rolled in the lag zone. E.B.Lozhechnikov, V.V.Lozhechnik, O.V.Chachin, A.I.Shilovich (Polytech. Inst., Minsk, Belorussian SSR).

Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.688-91 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.8-11 (Sept. 1982). [received: March 1983]

It was found that the rate of travel of powder in plane sections decreased with increasing distance from the roll surfaces. In the vicinity of the plane of symmetry, at $X=0$, powder may be forced to move in the direction opposite to the rolling direction. Feed of powder into this zone is effected through its movement in the direction at right angles to the rolling direction. (3 refs.)

73020 Control over the structure of hard metals and other heterophase materials produced by liquid-phase sintering. I. Liquid-phase migration and general principles of sintering of 'skeletonless' alloys. O.P.Kolchin (All-Union Sci.-Res. & Design Inst. of Refractory Metals & Hard Alloys, USSR).

Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.694-7 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.14-18 (Sept. 1982). [received: March 1983]

It is concluded that binder migration can be prevented or at least minimised by ensuring even heating of the whole blank on transition to LPS and during the melting of the binder, and even cooling after LPS and during the solidification of the melt. This can best be achieved in stationary, preferably vacuum, furnaces. Excessive heating of blanks above the melting point of their binder and prolonged soaking during LPS must be avoided. (12 refs.)

73021 Hot pressing dilatometry in the study of sintering mechanisms. R.J.Brook, E.Gilbart, D.Hind, J.Vieira (Dept. of Ceramics, Univ. of Leeds, Leeds, England).

Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.585-90

The use of pressure as a variable during studies of sintering is valuable in two ways; it indirectly reduces the interference from such processes as grain growth and surface diffusion and it directly distinguishes between mechanisms with different pressure dependence. Results for the sintering of β alumina and magnesia are reported. (8 refs.)

73022 Recent trends in understanding dynamic compaction of powders. H.Palmour,III (North Carolina State Univ., Raleigh, NC, USA), V.D.Linse, R.M.Spriggs.

Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.611-18

Reviews discernible trends toward improved scientific understanding of the behaviour of particulate materials being subjected to compaction by shock waves. (29 refs.)

73023 The modeling of rapidly solidified powders. R.J.Patterson,II (Government Products Div., Pratt & Whitney Aircraft Group, West Palm Beach, FL, USA).

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.123-30

In the past several years rapid solidification technology has been extended from the realm of splats and foils to powders. This paper surveys several of the models that have been developed for such powders and considers their comparison with experimental results. (26 refs.)

73024 An automated laboratory apparatus for the production of rapidly solidified submicron powders. J.Perel, J.F.Mahoney, S.Taylor, Z.Shanfield, C.Levi (Phrasor Sci. Inc., Duarte, CA, USA).

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.131-6

The electrohydrodynamic (EHD) method of spraying fine liquid droplets from a liquid state, in a vacuum environment, was developed and used to produce amorphous, microcrystalline, single crystal, bicrystalline and tricrystalline powders. Studies of these powders have contributed towards increasing the knowledge of extended solubility, nucleation, metastable phases, undercooling effects, etc. Coatings and films have been produced by collecting the liquid droplets before solidification. An automated instrument based upon the EHD method, the micro-particle processor, is computer operated and allow a material scientist not completely acquainted with the EHD process to perform sophisticated experiments on materials of his choosing. Electron transparent powders close to 3 μm and large powders up to 10 μm have been collected and observed. Cooling rates above 10^7 K/s have been achieved. Applications using powders include: new alloy compositions, use as AEM standards, in-situ remelt experiments in the electron microscope etc. (4 refs.)

Electrical behaviour of doped-yttria stabilized zirconia ceramic materials .... See Entry 72156

Structure formation in and magnetic properties of a P/M iron-chromium-cobalt alloy .... See Entry 72639

Some optical characteristics of powdered tellurites of rare-earth elements .... See Entry 72760

The influence of English terminology used in powder metallurgy on terms formation in the same field, expressed in other languages .... See Entry 72973

Analysis of in situ rapid solidification of submicron Al-Ge eutectic powders using transmission electron microscopy .... See Entry 73025

Effect of composition of powder mixtures and rolling temperature on the compactibility and properties of strip .... See Entry 73027

Isostatic shaping of parts in a heat-resisting nickel alloy .... See Entry 73029

Reductive additives in powder metallurgically prepared Cu-Nb_3Sn composite wires .... See Entry 73030

Formation of properties of powdered carbide steels under quasi-isostatic pressing .... See Entry 73031

Nickel base metallic glass powders for application as plasma sprayed coatings .... See Entry 73032

Cooling rates and fine microstructures of RSR and argon atomized superalloy powders .... See Entry 73033

Production, properties, and possible application of dispersion hardened copper .... See Entry 73034

Dependence of compaction on the glass transition temperature of the binder phase .... See Entry 73037

Densification, thermal diffusion and Na vapor resistance of Y_2O_3 ceramics .... See Entry 73038

Hot-pressed silicon nitride with a small amount of MgO added .... See Entry 73039

On the use of powder beds in the nitridation and subsequent densification of RBSN .... See Entry 73040

Sintering of PZT ceramics. II. Effect of PbO content on densification kinetics .... See Entry 73042

Investigation of phase stability in the system SiC-AlN .... See Entry 73043

Sintering magnesium oxide obtained by the chemical beneficiation of magnesite .... See Entry 73045

Isostatic pressing technology for refractory materials .... See Entry 73046

Effect of sintering conditions on the microstructure and electromagnetic properties of Li-Mg-Mn ferrite memory elements .... See Entry 73049

Hot-pressed oxynitrides in the system AlN-Al_2O_3 .... See Entry 73050

Hot pressing and properties of different Si_3N_4 qualities .... See Entry 73051

Fabrication of non-oxide ceramics by hot isostatic pressing .... See Entry 73052

Sintering of PZT ceramics. I. Atmosphere control .... See Entry 73053

Effect of application of ultrasound during pressing on the structure of tungsten carbide base materials .... See Entry 73055

The kinetics of densification of binary titanium-chromium diboride with copper-nickel binder .... See Entry 73057

Sintering of glass bonded ceramic barium hexaferrite magnetic powders .... See Entry 73059

Preparation, electrical resistivity and its temperature dependence of RuO_2-polystyrene composite powder .... See Entry 73061

Features of heat treatment of sintered type M5F5 fast-cutting steels .... See Entry 73099

Compaction effect on flexural behaviors of fiber reinforced concretes .... See Entry 73142

Deformation behavior of blended elemental Ti-6Al-4V compacts .... See Entry 73152

The tensile strengths of single powders and binary mixtures .... See Entry 73154

Structure and properties of permeable fine-fiber materials produced from powders .... See Entry 73157

Mechanical properties of sintered and nitrided laser-synthesized silicon powder .... See Entry 73187

Microstructures and mechanical properties of hot isostatically pressed powder metallurgy alloy APK-1 .... See Entry 73204

Formation of the contact zone between a detonation-deposited coating and a basis material .... See Entry 73278

An experimental study on the relationships between compressibility, fluidity and cohesion of powder solids at small tapping numbers .... See Entry 73303

81.20G Specific metals and alloys (compacts, pseudoalloys)

73025 Analysis of in situ rapid solidification of submicron Al-Ge eutectic powders using transmission electron microscopy. M.J.Kaufman, H.L.Fraser (Materials Res. Lab., Univ. of Illinois, Urbana, IL, USA).

Metall. Trans. A (USA), vol.14A, no.4, p.623-33 (April 1983).

Submicron powders of Al-30.3 at. pct Ge (eutectic), produced by electrohydrodynamic atomization, have been analyzed in a transmission electron microscope operating at 120 kV. Amorphous and complex crystalline structures were observed in the as-atomized condition. By using the electron beam as a local heating source, powders could be either annealed at temperatures below their melting point or melted. Molten powders were quenched at various cooling rates by altering the rate of beam obstruction. Using this technique, nonequilibrium structures were produced including metastable phases and mixed amorphous/crystalline microstructures. These various structures have been related to cooling rates and compared with the as-atomized structures. Crystallization of the amorphous regions produced by this technique has also been studied. (16 refs.)

73026 Metallic glasses. P.G.Zielinski (Inst. Inzynierii Materialowej, Politech. Warszawska, Warszawska, Poland).

Szklo & Ceram. (Poland), vol.33, no.3-4, p.61-5 (Sept.-Dec. 1982). In Polish. [received: April 1983]

Glass transformations in metallic systems are described. The technique of rapid cooling from the liquid phase for the production of metallic glasses is discussed. The method of continuous casting of metallic glasses in the form of ribbons is analysed. The conditions for securing the glass transformation and of obtaining a commercial product are described. (22 refs.)

73027 Effect of composition of powder mixtures and rolling temperature on the compactibility and properties of strip. G.A.Vinogradov, A.M.Musikhin, A.I.Otrok (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).

Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.691-3 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.11-13 (Sept. 1982). [received: March 1983]

Results are presented of a study of the rolling of high-alloy mixtures of PZh4r atomized iron powder (GOST 9849-74) and ground FS75 ferrosilicon (GOST 1415-70). The effect of mixture composition on the mechanical properties of cold- and hot-rolled strip was determined. (4 refs.)

73028 Electric-spark alloying (ESA) of steel with titanium carbide in its homogeneity range. A.D.Verkhoturov, F.F.Egorov, M.D.Smolin, I.A.Podchernyaeva (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).

Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.705-8 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.28-31 (Sept. 1982). [received: March 1983]

It is concluded that correlation exists between changes in the parameters of the process of ESA of steel with titanium carbide in its homogeneity range and changes in the electronic structure of TiC_x. The erosion of titanium carbide, weight gain of the steel cathode, and proportion of fine-fraction particles in the erosion products of TiC grow with increasing degree of completeness of the carbon sublattice. This promotes growth of the alloyed layer, and is a result of a strengthening of the covalent component of the Ti-C bond, which predominates in the electronic energy spectrum of TiC_x. It has been found that the number of pearlitic colonies in the spark-heat-affected zone falls with decreasing distance from the alloyed surface, due to carbon impoverishment of this zone resulting from the carbon combining chemically with the titanium. (6 refs.)

73029 Isostatic shaping of parts in a heat-resisting nickel alloy. V.K.Orlov, M.A.Mukhametkulov, E.P.Kratt, V.I.Kosin, V.I.Kostyukov (All-Union Inst. of Light Alloys, USSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.747-9 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.75-8 (Sept. 1982). [received: March 1983]
A study was made of the variation of the density and thermal diffusivity of EP-741P nickel superalloy powders during isostatic shaping in hermetically sealed capsules. The steel capsules used in experiments had diameters of 90, 350, and 505 mm and heights of 300, 142, and 180 mm, respectively. The capsules were fitted with thermocouples. Special hermetic devices were employed for passing the thermocouples through the capsule walls. The thermocouple junctions were made hermetic by welding the thermoelectrodes together with the cable armor. Capsules filled with 70- to 300-μm-diameter granules were subjected to vibratory densification, after which they were degassed, hermetically sealed, and heated in an isostatic press under the required conditions. Temperature measurements were made with a PP-63 potentiometer. (4 refs.)

73030 Reductive additives in powder metallurgically prepared Cu-Nb_3Sn composite wires. K.Mrowiec, R.Bormann, H.C.Freyhardt (Inst. fur Metallphys., Univ. Gottingen und Sonderforschungsbereich Gottingen/Clausthal, Germany).
Z. Metallkd. (Germany), vol.74, no.5, p.323-9 (May 1983). In German.
The critical currents of microcomposite superconductors strongly depend on a well-developed fibre structure. Oxygen, incorporated during the powder metallurgical process, complicates the preparation of Cu-Nb_3Sn microcomposite wires. By adding a powder component with a larger binding enthalpy for oxygen than Nb, the oxygen can be bound as the appropriate oxide. The development of the fibre structure during cold deformation of the compound is influenced by the solubility of the reductive additives Al, Mg, Zr, Hf and Ca in the copper matrix as well as by the distribution of the copper-rich phases and oxide particles. By measuring the critical temperature of Nb, the residual oxygen content can be estimated which characterizes the degree of purification. (23 refs.)

73031 Formation of properties of powdered carbide steels under quasi-isostatic pressing. V.M.Gorokhov, M.M.Dechko, E.A.Doroshkevich, O.V.Roman (Powder Metall. Assoc., Minsk, USSR).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.625-9
The method of quasiisostatic hot pressing with the pressure applied on a compacting part through intervening media provides for high efficiency densification of porous materials during compaction. High pressure compaction and shear deformations in material make it possible to produce high density parts with fine structure and improved physical and mechanical properties. This method is believed to produce best results when applied to high density billets production from poorly compactable materials including hard alloys and carbide steels. (4 refs.)

73032 Nickel base metallic glass powders for application as plasma sprayed coatings. V.Panchanathan (Marko Materials Inc., N Billerica, MA, USA), C.L.Tsai, S.Whang.
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.137-9
New nickel rich alloys containing molybdenum and chromium prepared as metallic powders are reported. Using standard plasma spray techniques, these powders (-170 mesh) can be deposited onto metallic substrates as dense, well bonded structural strength, hardness and good corrosion resistance in various corrosive media. (2 refs.)

73033 Cooling rates and fine microstructures of RSR and argon atomized superalloy powders. F.Cosandey, R.D.Kissinger, J.K.Tien (Henry Krumb School of Mines, Columbia Univ., New York, NY, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.173-8
Superalloy powders of an IN 792 plus Hf type alloy produced from rapid solidification rate (RSR) and argon atomized process (AA) techniques are analyzed and compared according to particle size. Characterization of powders include surface and interior morphology, particle size and void distribution, cooling microstructures, microcrystallinity, microsegregation and especially dendrite arm spacing and cooling rates. It is found that, for the alloy studied, RSR cooling rates are a factor of only two to four greater than those for AA, regardless of particle size. (9 refs.)

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting .... See Entry 69790

Structure formation in and magnetic properties of a P/M iron-chromium-cobalt alloy .... See Entry 72639

Effect of application of ultrasound during pressing on the structure of tungsten carbide base materials .... See Entry 73055

Formation and stability of extended solid solutions made by rapid quenching from the melt .... See Entry 73077

Rapid solidification of metastable materials .... See Entry 73078

Features of heat treatment of sintered type M5F5 fast-cutting steels .... See Entry 73099

Deformation behavior of blended elemental Ti-6Al-4V compacts .... See Entry 73152

Structure and properties of permeable fine-fiber materials produced from powders .... See Entry 73157

Microstructures and mechanical properties of hot isostatically pressed powder metallurgy alloy APK-1 .... See Entry 73204

Formation of the contact zone between a detonation-deposited coating and a basis material .... See Entry 73278

81.20J Dispersion-,fibre-, and platelet-reinforced metal-based composites

73034 Production, properties, and possible application of dispersion hardened copper. H.Oppenheim (Inst. fur Chem. Technol Anorganischer Stoffe, Tech. Univ. Wien, Wien, Austria).
Z. Metallkd. (Germany), vol.74, no.5, p.319-22 (May 1983). In German.
Dispersion hardened copper with a content of Al_2O_3 up to 24 vol.% can be produced by milling of Cu- and Al-powder in oxidizing atmosphere, subsequent diffusion and reduction annealing of the milled powder and compaction by hot extrusion or powder forging. The properties of the metals are determined both by the content of dispersoid and the production parameters. Careful choice and control of the temperature is of great importance for powder forging, for the strength will be reduced at too high temperatures by recovery and recrystallization and at too low temperatures by unsound bounding between the individual granules. The materials seem to be interesting for applications where high strength and good electrical conductivity at high temperatures are requested. Experiments where these mateials were used as electrode tips for point welding gave good results. (24 refs.)

73035 Casting of laminated ribbon using a modified melt-spinning technique. R.V.Raman (Battelle Columbus Labs., Columbus, OH, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.141-4
Laminated metal-metal and metal-semiconductor ribbons have been prepared by a modified melt-spinning technique. Characterization studies have been carried out on laminated Sn-Zn, Ge-Al, InSb-CuZr and some other materials. Characteristics of these ribbons and their potential applications are described. (11 refs.)

73036 Consolidation of $Ni_{60}Nb_{40}$ metallic glass strips into metal matrix composites. S.J.Cytron (US Army Armament Res. & Dev. Command, Dover, NJ, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.145-9
To fully utilize the promising mechanical properties of metallic glasses, consolidation techniques need to be developed to incorporate them into large bulk forms. The author describes preliminary results on the consolidation of $Ni_{60}Nb_{40}$ metallic glass strips into an aluminum alloy matrix. The consolidation was achieved without the degradation of the metallic glass by employing a superplastic aluminum alloy as the matrix material. The consolidations were accomplished at a superplastic forming temperature compatible with the metal matrix material and sufficiently below the critical 650°C crystallization temperature of the $Ni_{60}Nb_{40}$ metallic glass. Initial studies employed an aluminum$-$5% calcium$-$5% zinc alloy as the metal matrix material. (11 refs.)

Electric-spark alloying (ESA) of steel with titanium carbide in its homogeneity range .... See Entry 73028

81.20L Ceramics and refractories

73037 Dependence of compaction on the glass transition temperature of the binder phase. R.A.DiMilia, J.S.Reed (Alfred Univ., Alfred, NY, USA).
Am. Ceram. Soc. Bull. (USA), vol.62, no.4, p.484-8 (April 1983).
Spray-dried alumina powder granules were compacted at 24°C in a polished, hardened steel die using a constant punch velocity. Variables investigated were the concentration of polyvinyl alcohol binder phase (1-2.7 wt.%), concentration of absorbed moisture (0.2-1.6 wt.%), and the basic particle size. The yield strength of powder granules decreased markedly when the concentration of adsorbed moisture was sufficient to lower the glass transition temperature (T_g) of the binder below 24°C. The yield strength ranged less widely with binder content when the granules were stored at higher humidity. Power particle size affected both the granule strength and the maximum pressed density. Three distinct compaction stages were characterized. Hg porosimetry and microstructure analyses indicated that the reduction of intergranule porosity as dependent on granules strength and a denser, more uniform compact is produced when T_g of the binder phase is below the pressing temperature. (7 refs.)

73038 Densification, thermal diffusion and Na vapor resistance of Y_2O_3 ceramics. Y.Tsukuda (Hitachi Metals Ltd., Saitama, Japan).
Am. Ceram. Soc. Bull. (USA), vol.62, no.4, p.510-12 (April 1983).
The sintering rate resistivity against corrosion by saturated Na vapour, and thermal diffusivity of black (reduced) sintered Y_2O_3 bodies were studied and compared with those for colorless Y_2O_3 bodies. The sintering rate for black Y_2O_3 bodies at 2373 to 2537K is higher than that for colorless bodies. Both types of bodies exhibit the same resistivity to corrosion by saturated Na vapour at 1473K. The thermal diffusivity and conductivity of black Y_2O_3 bodies are greater than those of colorless bodies. (9 refs.)

73039 Hot-pressed silicon nitride with a small amount of MgO added. S.B.Hanna (Refractories Lab., Nat. Res. Centre, Cairo, Egypt), G.Grathwohl, F.Thummler.
CFI-Ceram. Forum Int. Ber. Dtsch. Keram. Ges. (Germany), vol.60, no.2-3, p.64-9 (April 1983). In German, English.
Hot-pressed Si_3N_4 (HPSN) was mixed with a small amount of MgO ($\leq$0.8%). The shrinkage undergone during hot-pressing and the ultimate density were studied as functions of manufacturing conditions. The phase transition and formation of microstructure during hot-pressing were monitored and described. HPSN specimens containing 0.07% MgO can be compacted to 99% TD. In all of the examined specimens, the entire α-Si_3N_4 content was converted to β-Si_3N_4. Increasing the MgO content was found to favor the appearance of elongated β grains, whereby the average grain size increased from 0.8 to 1.7 microns. (7 refs.)

73040 On the use of powder beds in the nitridation and subsequent densification of RBSN. J.R.G.Evans, A.J.Moulson (Dept. of Ceramics, Univ. of Leeds, Leeds, England).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.236-8 (May 1983).
The authors show that unless the MgO content of RBSN is controlled at all stages in the fabrication process, reproducible sintering kinetics cannot be obtained nor optimum densities achieved. The use of powder beds both during nitridation and densification is shown to be one way of reducing MgO loss. (4 refs.)

73041 Formation of NbC and TaC by solid-state reaction. S.Shimada, T.Koyama, K.Kodaira, T.Mastushita (Dept. of Appl. Chem., Hokkaido Univ., Sapporo, Japan).
J. Mater. Sci. (GB), vol.18, no.5, p.1291-6 (May 1983).
The formation of NbC and TaC by solid-state reaction of Nb_2O_5 and Ta_2O_5 with carbon, respectively, was studied at 1000 to 1285°C by X-ray diffraction. Factors affecting the formation of the carbides, such as the nature of the

reaction vessel, the molar ratio of carbon/oxide, the form of reactant carbon, etc., were examined. By covering the graphite crucible and increasing the molar ratio of carbon to oxide. Complete formation of NbC and TaC could be achieved in about 60 min at low temperatures (1170 and 1225°C, respectively). The beneficial effect of covering the crucible is ascribed to the retention of CO which facilitates the reaction at low temperatures. The formation kinetics of NbC and TaC obey a first-order equation, with activation energies of 90 and 93 kcal mol^{-1}, respectively. Possible mechanisms for the solid-state reactions are discussed. (7 refs.)

73042 Sintering of PZT ceramics. II. Effect of PbO content on densification kinetics. A.I.Kingon, J.B.Clark (Nat. Phys. Res. Lab., CSIR, Pretoria, S Africa).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.256-60 (April 1983).
For pt.I see ibid., vol.66, no.4, p.253-6 (1983). The presence of a PbO-rich liquid phase was previously shown to affect the densification of lead zirconate-lead titanate (PZT) ceramics. The authors attempt to quantify the role of this liquid phase. Increasing amounts of PbO-rich liquid phase is shown to increase the rates of densification in the initial and intermediate stages, but lower the final density. This behavior is discussed. In the case of PbO-deficient samples, the amount of the deficiency is shown to affect the densification rate at the final stage. (14 refs.)

73043 Investigation of phase stability in the system SiC-AlN. W.Rafaniello, M.R.Plichta, A.V.Virkar (Dept. of Materials Sci. & Engng., Univ. of Utah, Salt Lake City, UT, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.272-6 (April 1983).
Dense samples of several compositions in the system SiC-AlN were fabricated by hot-pressing. The SiC-AlN powder was prepared by carbothermal reduction of an intimate mixture of alumina, silica, and carbon in a nitrogen atmosphere. X-ray diffraction and electron and optical microscopy were used to determine the chemical and microstructural characteristics of the hot-pressed specimens. Materials with bulk compositions between 15 and 75 wt.% AlN were found to be nonhomogeneous when hot-pressed below 2100°C. These materials were determined to be a mixture of SiC-AlN solid solutions with different compositions. The observed compositional variations were distinctly bimodal. The source of the inhomogeneity was the starting SiC-AlN powder. (9 refs.)

73044 Specific volume diagrams for ceramic processing. G.Y.Onoda,Jr. (Univ. of Florida, Gainesville, FL, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.297-301 (April 1983).
Graphical procedures are presented for analyzing the volume-weight relations in ceramic particulate systems encountered in processing. The procedures emphasize the advantages of working with specific volume rather than density. By using the concept of partial specific volumes, the expected variations in specific volume with composition for many special cases are readily deduced. Comparing experimental and theoretical variations gives meaningful insights into the space-filling characteristics of real systems. (5 refs.)

73045 Sintering magnesium oxide obtained by the chemical beneficiation of magnesite. K.V.Simonov, L.D.Bocharov, N.S.Afinogenova, V.G.Abbakumov, V.M.Gropyanov (Leningrad Technol. Inst. for Cellulose-Paper Industry, USSR).
Refractories (USA), vol.23, no.7-8, p.375-83 (July-Aug. 1982). Translation of: *Ogneupory (USSR),* vol.23, no.7, p.43-50 (July 1982). [received: April 1983]
A quantitative relationship was established for sintering chemically beneficiated magnesite and a method of obtaining the MgO; also established were the parameters of hydrolysis of the magnesium chloride, the quantity of residual volatiles, the temperature and rate of thermal activation of residual volatiles, the temperature and rate of thermal activation of the magnesium oxide, not washed, and washed to get rid of the calcium impurities, and also the completeness of the hydration of the magnesium oxide during leaching. A production flow line is proposed for obtaining from the enriched material sintered periclase clinkers differing in density and degree of purity. (7 refs.)

73046 Isostatic pressing technology for refractory materials. E.V.Degtyareva, Ya.M.Grinberg (Kharkov Automobile-Road Komsomol Inst., Ukrainian SSR).
Refractories (USA), vol.23, no.7-8, p.395-401 (July-Aug. 1982). Translation of: *Ogneupory (USSR),* vol.23, no.8, p.6-13 (Aug. 1982). [received: April 1983]
In the USSR and abroad numerous investigations have been carried out into the process of isostatic pressing of refractories and ceramics. The method is distinguished primarily by excellent physical properties, and density and strength which are uniform throughout the volume. The method is useful for making large, complex articles, including those which cannot be shaped by other methods. Isostatic pressing is widely used in various technologies. At present, Soviet and foreign industries have shown that it is advantageous to develop this method for the metallurgical industry, in particular for producing stopper-monoblocks and nozzles for the donkey ladles of continuous casting machines, crucibles, etc. (44 refs.)

73047 Dependence of the dielectric properties, porosity, and apparent density of quartz ceramic on the phase of composition. Yu.A.Polonskii, V.G.Sloushch, T.I.Litovskaya, S.P.Shmitt-Fogelevich (Eastern Inst. of Refractories, USSR).
Refractories (USA), vol.23, no.7-8, p.432-6 (July-Aug. 1982). Translation of: *Ogneupory (USSR),* vol.23, no.8, p.44-8 (Aug. 1982). [received: April 1983]
It has been established that there is a connection between the porosity, the apparent density, and the concentration of cristobalite and the dielectric constant of a quartz ceramic; this connection may be used to carry out online, nondestructive monitoring of quality. A reduction in porosity of the quartz ceramic associated with an increase in temperature is accompanied by an increase in the concentration of cristobalite. In the experimental quartz ceramic a significant amount of cristobalite (>5%) appeared with a porosity <13%. (10 refs.)

73048 Some properties of fine-grained mixtures of $ZrSiO_4$-ZrO_2. I.G.Orlova, A.I.Gudilina, N.V.Gul'ko (Sci.-Res. Inst. of Refractories, Ukrainian SSR).
Refractories (USA), vol.23, no.7-8, p.437-41 (July-Aug. 1982). Translation of: *Ogneupory (USSR),* vol.23, no.8, p.48-53 (Aug. 1982). [received: April 1983]
The effect of additions of ZrO_2 in monoclinic and cubic modifications and also of $Zr(OH)_4$ on the swelling, thermal-shock resistance, and glass-resistance of high-density, zircon refractories has been studied. It is shown that the most effective addition for lowering the additional growth of the refractory almost fivefold was a mixture consisting of 9.5% monoclinic ZrO_2 and 0.5% $Zr(OH)_4$. This additive also significantly increased the thermal-shock resistance of the zircon refractories and the glass resistance as a result of the lower decomposition of $ZrSiO_4$ and the higher concentration of ZrO_2 in the contact zone. The density and electrical resistivity of the refractory was maintained at a high level. (7 refs.)

73049 Effect of sintering conditions on the microstructure and electromagnetic properties of Li-Mg-Mn ferrite memory elements. V.M.Minin.
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.698-701 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR),* vol.21, no.9, p.19-23 (Sept. 1982). [received: March 1983]
A study was made of the effect of sintering conditions on the microstructure and electromagnetic properties of memory elements from a thermally stable Li-Mg-Mn ferrite produced from a charge of composition corresponding to 3 VT grade. Shrinkage measurements were made on 35-mm-diameter, 40-mm-high specimens whose density before sintering was 2.2 ± 0.3 g/cm^3. The ferrite mass was subjected to three milling and two calcining operations. Specimen sintering conditions were investigated in a KO-14 furnace placed in an autoclave. Heating and cooling were performed in a vacuum. Microstructural analysis was carried out with an MMR-2R microscope. Static magnetic parameters were measured, using a ballistic apparatus with an F190 microwebermeter. (7 refs.)

73050 Hot-pressed oxynitrides in the system AlN-Al_2O_3. T.Sakai (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.591-6
The alumina addition more than 2.5 mol.% in the system AlN-alumina leads to densify more than 99% of theoretical density by hot pressing. Oxynitride of spinel structure was found in the whole composition range in this system in the compact hot-pressed at 1650°C. Spinel reacted with AlN to form five pseudopolytypes AlN at above 1850°C. Thermal conductivities of the compacts were influenced by not only the amount of oxygen but also crystal structure of second phase in the compact intensely. High temperature flexural strength of the AlN compact was improved with addition of 5-15 mol.% alumina and the compact was composed pseudopolytype AlN after hot pressing at 1900°C. When the concentration of the AlN composition in the oxynitride of spinel was well controlled, the compact could have a good infrared transmittance. (7 refs.)

73051 Hot pressing and properties of different Si_3N_4 qualities. G.Grathwohl (Inst. fur Werkstoffkunde, Univ. Karlsruhe, Karlsruhe, Germany), S.B.Hanna, F.Thummler.
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.597-604
α-Si_3N_4 powders of high activity (11-14 m^2/g) are available either from industry or by ball milling of conventional powders in Si_3N_4-lined vessels. The improved hot pressing behaviour of thse powders has been investigated with and without MgO additions. Full densification can be achieved with extremely small amounts of MgO (<0.1%), when this is added in form of a contamination during the milling process; 0.3-0.4% MgO are necessary when normal mixing procedure is applied. The resulting microstructures are dependent on the amount of additives. Oxidation, strength and creep properties are presented and discussed. (12 refs.)

73052 Fabrication of non-oxide ceramics by hot isostatic pressing. T.Yamada, M.Shimada, M.Koizumi (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.605-10
Hot isostatic pressing of highly pure Si_3N_4 and TiN were performed at 100-200 MPa and 1100-1900°C, and effects of pressure/temperature/time parameters on densification were studied. Highly pure α-Si_3N_4 powders could be densified at 94% theoretical density without additives, when $\alpha \rightarrow \beta$ phase transformation occurred. A fine grained and highly dense TiN ceramic body was fabricated without additives, using submicron powders as starting materials. (10 refs.)

Electrical behaviour of doped-yttria stabilized zirconia ceramic materials .... See Entry 72156

How corundum refractories are wetted by molten steel .... See Entry 72185

Hot pressing dilatometry in the study of sintering mechanisms .... See Entry 73021

Mechanical properties of sintered and nitrided laser-synthesized silicon powder .... See Entry 73187

81.20N Cermets, ceramic and refractory composites

73053 Sintering of PZT ceramics. I. Atmosphere control. A.I.Kingon, J.B.Clark (Nat. Phys. Res. Lab., CSIR, Pretoria, S Africa).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.253-6 (April 1983).
Methods of PbO atmosphere control during the sintering of PZT ceramics are briefly reviewed. The problem of atmosphere control of PZT compositions containing a PbO excess ($PbO/(Zr,Ti)O_2 > 1$) is discussed. Weight-loss experiments were performed to compare with behavior predicted by reference to the PbO-rich part of the ternary PbO-ZrO_2-TiO_2 phase diagram. The results indicated that the PbO activity of a PZT composition is a function of the excess PbO content, contrary to earlier reports. Experimental procedures were established in order to control the PbO content within satisfactory limits. The effects of various packing powders on the PbO content of sintered PZT compacts were evaluated. (13 refs.)

73054 Partially stabilized zirconia. S.Yuuhaku, H.Okinaka, H.Torii, T.Miyazawa (Wireless Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.154-62 (Feb. 1983). In Japanese.
A partially stabilized zirconia is a solid electrolyte body which functions as an oxygen sensor for an automobile engine system, because it has high resistance to mechanical stress and thermal shock. However, it has the drawback that the resistance is remarkably small when it is held at a certain low temperature, such as about 200°C. In order to remove this drawback, basic materials and preparation process of the material were investigated. It was found that two preparation conditions are important for improvement of the drawback: addition of MgO, CaO and SiO_2 to a partially stabilized zirconia by 5 mol% of Y_2O_3; repetition of calcination-crushing cycle. The partially stabilized zirconia ceramic obtained under the above preparation conditions has a high bending strength (30 $kg.mm^{-2}$), and withstands highly thermal shock (170 deg). Furthermore, even if the ceramic is held at 200°C for 500 h, its bending strength still remains high. (11 refs.)

73055 Effect of application of ultrasound during pressing on the structure of tungsten carbide base materials. L.T.Buchek, I.G.Tereshchenko (Correspondence Polytech. Inst., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.712-14 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.35-8 (Sept. 1982). [received: March 1983]
An investigation was carried out to determine the effect of USV on the structure of WC base compacts. The action of USV applied during pressing comminuted the tungsten carbide particles and decreased the porosity of the compact and hence the volume of infiltrating material, which brought about an increase in density. Application of USV promoted a more uniform distribution of the components in VK15 compacts. (4 refs.)

73056 Electrical resistivity, magnetoresistance and microstructure of carbon-fiber/CVD-carbon composite. S.Kimura (Res. Lab. of Engng., Materials, Tokyo Inst. of Technol., Yokohama-shi, Japan), T.Hagio, E.Yasuda, Y.Tanabe, Y.Hishiyama, Y.Kaburagi.
Yogyo-Kyokai-Shi (Japan), vol.91, no.3, p.121-5 (1983). In Japanese.
Three types of carbon-fiber/CVD-carbon composite, in which carbon matrix was isotropic (ISO), rough columnar (RC) or smooth columnar (SC), were prepared at 1300°C by chemical vapor deposition from propane-hydrogen mixtures. The electrical resistivites of the as-deposited composites were 2.1×10^{-3}, 1.0×10^{-3} and 1.6×10^{-3} Ω.cm for ISO, RC and SC composites, respectively. The transverse magnetoresistances of all these composites showed negative values at 4.2K. The electrical resistivities of their 3000°C heat-treated products were 1.2×10^{-3}, 0.3×10^{-3} and 0.6×10^{-3} Ω.cm, respectively. The value of the transverse magnetoresistances of the heat-treated RC and SC composites were positive at 77K, but that of ISOP composite was negative. The results indicate that all the the as-deposited CVD carbon are turbostatic in structure, and the ISO carbon is non-graphitizing, while the other two, especially RC carbon is easily graphitizing. (16 refs.)

73057 The kinetics of densification of binary titanium-chromium diboride with copper-nickel binder. M.S.Koval'chenko, L.F.Ochkas (Inst. for Problems of Materials Sci., Acad. of Sci., Kiev, Ukrainian SSR).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.619-24
An experimental study was carried out of densification kinetics for powder mixtures of titanium-chromium diboride with copper-nickel binder during hot pressing. As a result of the analysis of the kinetics above in the framework of volume viscous flow theory the porous solid densification is shown to be affected by nonlinear steady-state creep with dependence of solid flow rate on quadrate of stress. Activation energy was evaluated regularly decreasing from 2,8 to 2,0 eV as binder content rising in alloys of titanium-chromium diboride. The mechanism is discussed briefly. (11 refs.)

Compaction effect on flexural behaviors of fiber reinforced concretes ....See Entry 73142

Effect of the type of binding material on the properties of refractory glass-fiber heat-insulation products ....See Entry 73155

81.20P Glasses

73058 Silicon-free oxynitride glasses via nitridation of aluminate glass-melts. L.M.Bagaasen, S.H.Risbud (Dept. of Ceramic Engng., Univ. of Illinois, Urbana, IL, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C69-71 (April 1983).
Aluminate-oxynitride glasses were synthesized by melting calcium-aluminate-based compositions with various amounts of AlN in a nitrogen atmosphere. X-ray amorphous Ca-Al-Mg-Ba-O-N oxynitride glasses free of metallic inclusions containing up to ≈1 at.% N were obtained. Nitride additions increased the glass transition temperatures while decreasing thermal expansion, as in other Si-containing oxynitride systems. (9 refs.)

Sintering of porous glass ....See Entry 73017

Metallic glasses ....See Entry 73026

Nickel base metallic glass powders for application as plasma sprayed coatings ....See Entry 73032

Consolidation of $Ni_{60}Nb_{40}$ metallic glass strips into metal matrix composites ... .See Entry 73036

81.20Q Glass-based composites, vitroceramics

73059 Sintering of glass bonded ceramic barium hexaferrite magnetic powders. E.Lucchini, S.Meriani, G.Slokar (Appl. Industrial Chem. Inst., Univ. of Trieste, Trieste, Italy).
J. Mater. Sci. (GB), vol.18, no.5, p.1331-4 (May 1983).
Mixtures of low-melting glasses (glazes) and barium hexaferrite magnetic powders sinter at relatively low temperatures (800°C) and produce dense items in which excessive grain growth has been inhibited. (7 refs.)

Effect of the type of binding material on the properties of refractory glass-fiber heat-insulation products ....See Entry 73155

81.20S Polymers

73060 Stability of film casting of power-law liquids. G.R.Aird, Y.L.Yeow (Dept. of Chem. Engng., Univ. of Edinburgh, Edinburgh, Scotland).
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.1, p.7-10 (Feb. 1983).
The stability of the film casting process is examined and the power-law, constitutive equation is assumed. Methods of linear hydrodynamic stability theory are used to formulate the relevant eigenvalue problem. Neutral stability curves are obtained for different power-law indices, from which the critical extension ratios are deduced. (9 refs.)

Microstructure of semi-crystalline thermoplastics structural foams ....See Entry 71906

Hydrophilic polymeric membranes obtained by radiation cast-copolymerization of ethyl acrylate with various monomers ....See Entry 73137

81.20T Reinforced polymers and polymer-based composites

73061 Preparation, electrical resistivity and its temperature dependence of RuO_2-polystyrene composite powder. T.Nishizawa, M.Senna, H.Kuno (Faculty of Sci. & Technol., Keio Univ., Yokohama, Japan).
J. Mater. Sci. (GB), vol.18, no.5, p.1346-52 (May 1983).
RuO_2-polystyrene composite powder was prepared by admixing fine powdered RuO_2 and polystyrene beads thoroughly in ethanol. RuO_2-coated polystyrene beads were also prepared by direct suspension polymerization of styrene in an aqueous phase in the presence of a suspended RuO_2 powder. The apparent d.c. volume resistivity, hot-pressed composite was measured at various temperatures (20 to 80°C), pressures (3.5 to 35 MPa) and volume fractions of RuO_2, ϕ, (0.008 to 0.10). The volume resistivity increased linearly with temperature on a double logarithmic scale. The equilibrium volume resistivity at constant temperature, ρ_{aT}, decreased remarkably when ϕ increased from 0.025 to 0.04 for the mixed material, due to the establishment of a continuous network of RuO_2 in this region, as revealed by scanning electron microscopy. The composite prepared by direct polymerization completed a network of the conductive phase at a much smaller volume fraction of RuO_2. The average size of RuO_2 aggregates covering the surface of polystyrene agreed fairly well with the calculated value based on the simple geometry. (7 refs.)

73062 Alkali treatment of coir fibres for coir-polyester composites. S.V.Prasad, C.Pavithran, P.K.Rohatgi (Regional Res. Lab., Council of Sci. & Industrial Res., Kerala, India).
J. Mater. Sci. (GB), vol.18, no.5, p.1443-54 (May 1983).
Coir fibres were subjected to alkali treatment with a view to improving the wettability of coir fibres by a commercially available resin such as polyester. Tensile strength of the fibres increases by 15% when the fibres are soaked in 5% aqueous solution of NaOH at 28±1°C for 72 to 76 h after which it shows a gradual decrease. This decrease is much more pronounced when the alkali is replenished after every 24 h. SEM observations showed the removal of cuticle and tyloses from the surface of coir as a result of alkali treatment, resulting in a rough fibre surface with regularly spaced pits. The debonding stress of alkali-treated fibres from polyester matrix was 90% higher than that of untreated fibres from the same matrix. Incorporation of 0.30 volume fraction of untreated and treated fibres in polyester resulted in composites having 11% and less 5% porosity, respectively. Flexural strength, modulus and impact strength of composites containing alkali-treated fibres in polyester resulted in composites having 11% and less 5% porosity, respectively. Flexural strength, modulus and impact strength of composites containing alkali-treated fibres were 40% higher than those containing the same volume fractions of untreated fibres. Longitudinal ultrasonic velocity and sound attenuation measurements indicated less fibre segregation and better fibre-matrix bonding in composites containing alkali-treated fibres. (11 refs.)

Effect of silane coupling agents on mechanical and thermal properties of polyester resin concrete ....See Entry 73096

Straw-reinforced polyester composites ....See Entry 73141

81.30 PHASE DIAGRAMS AND MICROSTRUCTURES DEVELOPED BY SOLIDIFICATION AND SOLID-SOLID PHASE TRANSFORMATIONS

(see also 61. Structure of liquids and solids 64.70 Phase equilibria, phase transitions, and critical points)

73063 Isotropy of spinodal decomposition in Fe-30% Cr. S.Spooner, W.E.Brundage (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Scr. Metall. (USA), vol.17, no.4, p.573-4 (April 1983).
The authors report the results of neutron scattering measurements made on a single crystal of iron-30% chromium which has been decomposed within the spinodal region of the miscibility gap. (9 refs.)

73064 A theoretical analysis of the phase-decompositions based upon the non-linear diffusion equation. T.Miyazaki, T.Kozakai (Dept. of Metall. Engng., Nagoya Inst. of Technol., Nagoya, Japan), S.Mizuno, M.Doi.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.246-54 (April 1983).
A general form of the Fourier expression for the Cahn-Hilliard's flux equation is proposed, in which two kinds of the non-linear terms follow the linear term developed by Cahn, and computer-simulations for the time developments of phase-decompositions in some supersaturated solid solutions are derived on the basis of the Fourier expression. The phase-decompositions proceed to form periodic zone-arrangements in the high solute alloys, while in the low solute alloys a few composition peaks sparsely distributed appear. The diffusion-behaviors simulated for the phase-decompositions seem to be essential for the basic understanding on the formations of microstructures. (10 refs.)

73065 Formation of rutile type solid solutions in pseudobinary systems SnO_2-ABO_4 (A=Ga, Cr; B=Nb, Ta, Sb^{5+}) and SnO_2-AB_2O_6 (A=Mg, Zn; B=Sb^{5+}). T.Kikuchi, A.Watanabe, K.Uchida (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.3, p.110-16 (1983).
Rutile type solid solutions in both SnO_2-ABO_4 (A=Ga, Cr; B=Nb, Ta, Sb^{5+}) systems and SnO_2-AB_2O_6 (A=Mg, Zn; B=Sb^{5+}) systems were synthesized and their lattice parameters were investigated in each system. A complete series of solid solutions were found in the SnO_2-$GaSbO_4$ system at 1200°C and in the SnO_2-$CrNbO_4$ system at 1350°C. $CrSbO_4$ was soluble in SnO_2 up to 80 mol.% as the form of $A_{0.5}B_{0.5}O_2$ at 1200°C. Similarly, $GaNbO_4$ and $GaTaO_4$ were soluble up to 50 mol.% and up to 85 mol.% at 1300°C, respectively. In all cases, lattice parameters decreased with decreasing SnO_2 content. Sb-oxides dissolved in SnO_2 in air at 1200°C up to 2.3 atomic % expressed with Sb/(Sn+Sb). The lattice parameters of the sample with 2.3 atomic% Sb were $a=4.740\pm0.001$ Å and $c=3.190\pm0.0005$ Å. $ZnSb_2O_6$ (trirutile structure) was soluble in SnO_2 up to 50 mol.% as the form of $Zn_{1/3}Sb_{2/3}O_2$ at 1200°C; whereas SnO_2 dissolved in $Zn_{1/3}Sb_{2/3}O_2$ up to 20 mol.% at the same temperature. The lattice parameters decreased with decreasing SnO_2 content. Similarly, $MgSb_2O_6$ dissolved in SnO_2 up to 50 mol.% at 1250°C but SnO_2 was little soluble in $MgSb_2O_6$. (16 refs.)

A new family of tellurite glasses. I. Glass formation ....See Entry 71888

Comment on 'nomenclature and geometrical representation of invariant equilibria in multicomponent systems [and reply] ....See Entry 72080

Field-property bounds for porous sintered ceramics ....See Entry 72386

Features of heat treatment of sintered type M5F5 fast-cutting steels ....See Entry 73099

Measurement of visual information with texture analysis. II ... See Entry 73295

81.30B Phase diagrams of metals and alloys

73066 Diagram of state for the Yb-Ge system. V.N.Eremenko, K.A.Meleshevich, Yu.I.Buyanov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.3, p.83-8 (1983). In Ukrainian.
The structure of ytterbium-germanium alloys is studied by metallographic, chemical, X-ray and thermal analyses. For the first time the phase diagram is plotted. (8 refs.)

73067 Phase equilibria in iron ternary systems. V. Critical evaluation of constitutions of certain ternary alloys containing iron, tungsten, and a third metal. [addendum]. G.V.Raynor, V.G.Rivlin (Dept. of Metall. & Materials, Univ. of Birmingham, Birmingham, England).
Int. Met. Rev. (GB), vol.28, no.2, p.122-9 (1983).
For original work see ibid., vol.26, p.213-49 (1981). Work on the systems Fe-W and Fe-W-Ni, too recent to have been considered in the authors' assessment of the constitutions of ternary alloys based on iron and tungsten, has thrown new light on the nature of the equilibria in these systems. In this addendum the new work and its implications are described. The opportunity has also been taken to present additional data on certain aspects of the constitution of Fe-W-Cr alloys. (17 refs.)

73068 Calculation of the liquidus surface of the Ti-Mo-Al system. V.M.Danilenko, A.A.Rubashevskii (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.722-4 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.46-9 (Sept. 1982). [received: March 1983]
The results are presented of a calculation of the liquidus surface of the system under consideration, made with the aid of a model of subregular solutions. (5 refs.)

73069 Phase equilibria in the Sm-Re-B system. S.I.Mikhalenko, Yu.B.Kuz'ma, O.K.Shchur (Lvov State Univ., Lvov, Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.725-7 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.50-2 (Sept. 1982). [received: March 1983]
Presents a study of the phase equilibria and a search for new compounds in the Sm-Re-B system, using published information on the binary systems Sm-B, Re-B, and Sm-Re. In all, 120 specimens were prepared for investigation. The specimens were subjected to X-ray phase analyses and metallographic examinations. X-ray photographs were taken, using chromium radiation, in 57.3-mm-diameter Debye cameras. Microstructures were studied visually with an MIM-7 metallographic microscope. The results of phase analyses of the specimens were used for constructing an isothermal section of the Sm-Re-B constitution diagram at 1270K. (15 refs.)

73070 A thermodynamic analysis of the tin-tellurium system and calculation of the phase diagram. K.-C.Hsieh, M.S.Wei, Y.A.Chang (Dept. of Metall. & Mineral Engng., Univ. of Wisconsin-Madison, Madison, WI, USA).
Z. Metallkd. (Germany), vol.74, no.5, p.330-7 (May 1983).
The thermodynamic data of liquid Sn-Te alloys are analyzed in terms of an associated solution model in this model, it is postulated that 'SnTe' species exists in the liquid in addition to 'Sn' and 'Te'. This model with eight parameters quantitatively describes the thermodynamic data of the liquid alloys over a wide range of composition and temperature. These eight parameters consist of two for the temperature dependence of the association equilibrium constant and six for the interactions of 'Sn'-'SnTe' and 'SnTe'-'Te'. The Darken excess stability function for the liquid phase shows a pronounced maximum near 50 at.% Te. All three thermodynamic functions the Gibbs energy, enthalpy and entropy, show sharp minima also at 50 at.% Te. Based on the thermodynamic properties of the liquid alloys evaluated from the model and those of other phases in the system, the Sn-Te phase diagram is calculated. (47 refs.)

Glass-forming ability of the melt-quenched $(Fe_{1-y}Ni_y)_3B$ alloys ....See Entry 71883

Volumes of mixing of liquid alloys ....See Entry 72127

Transmission electron microscopy of an annealed and nitrided Fe-600 wt.ppm Ti alloy ....See Entry 73116

On γ and γ' phases composition in Ni-base superalloys after high-temperature exposure ....See Entry 73117

81.30D Phase diagrams of other materials

73071 Stable and metastable phase relations in the system ZrO_2-CaO. J.R.Hellmann, V.S.Stubican (Dept. of Materials Sci. & Engng., Pennsylvania State Univ., University Park, PA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.260-4 (April 1983).
The chemical equilibrium for the system ZrO_2-CaO was redetermined for temperatures above $\approx$1000°c by heating reactive powders for extended periods of time. The eutectoid decomposition of the cubic solid solution was found to occur at 1140°±40°C and 17.0±0.5 mol% CaO. Decomposition reactions in sintered cubic solid solutions were studied using electron diffraction and transmission techniques. Decomposition follows metastable extensions of the boundary lines which separate two-phase regions from the adjacent cubic solid solution region. The appearance of the diffuse diffraction features in the electron diffraction patterns of cubic solid solutions seems to be associated with short-range ordering of oxygen vacancies. Two ordered phases, $CaZr_4O_9$ and $Ca_6Zr_{19}O_{44}$, were synthesized and their upper limits of stability were determined to be 1235°±15° and 1355°±15°C, respectively. (18 refs.)

73072 Phase relations and ordering in the systems MgO-Y_2O_3-ZrO_2 and CaO-MgO-ZrO_2. J.R.Hellmann, V.S.Stubican (Dept. of Materials Sci. & Engng., Pennsylvania State Univ., University Park, PA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.265-7 (April 1983).
The phase relations in the systems MgO-Y_2O_3-ZrO_2 and CaO-MgO-ZrO_2 were established at 1220° and 1420°C. The system MgO-Y_2O_3-ZrO_2 possesses a much-larger cubic ZrO_2 solid solution phase field than the system CaO-MgO-ZrO_2 at both temperatures. The ordered δ phase $(Zr_3Y_4O_{12})$ was found to be stable in the system ZrO_2-Y_2O_3 at 1220°C. Two ordered phases ϕ_1 $(CaZr_4O_9)$ and ϕ_2 $(Ca_6Zr_{19}O_{44})$ were stable at 1220°c in the system ZrO_2-CaO. At 1420°C no ordered phase appears in either system, in agreement with the previously determined temperature limits of the stability for the δ, ϕ_1, and ϕ_2 phases. The existence of the compound $Mg_3Y_2O_6$ could not be confirmed. (27 refs.)

73073 The correlation of the thermodynamic properties of wustite by a gaussian based formalism. J.D.Esdaile (Div. of Mineral Engng., CSIRO, Clayton, Victoria, Australia).
Metall. Trans. A (USA), vol.14A, no.4, p.771-5 (April 1983).
A Gaussian-based formalism is used to correlate precisely the data of Darken and Gurry (1945) for the wustite phase of the industrially important system Fe-O within and at the boundaries of this phase. Equations are also given for the free energy and heats of formation of metastable FeO, wustite in equilibrium with γ-Fe, and Fe_3O_4 from γ-Fe and oxygen at 1 atm. (7 refs.)

73074 The ternary system CaF_2-CdF_2-CrF_3. Dimorphism of $CaCrF_5$ and CrF_3. M.Samouel, A.de Kozak (Lab. de Chimie Minerale, Univ. Pierre et Marie Curie, Paris, France).
Rev. Chim. Miner. (France), vol.20, no.1, p.37-44 (1983). In French.
The liquid-solid equilibria diagrams of the system CaF_2-CrF_3 and of the ternary system CaF_2-CdF_2-CrF_3 are established by DTA and X-ray investigation. Three definite compounds ($CdCrF_5$, $CaCrF_5$, Ca_2CrF_7) and three non-stoichiometric phases ($Cd_{1-x}Ca_xF_2$, $Cd_{1-x}Ca_xCrF_5$, $Ca_{2-2x}Cd_xCrF_{7-2x}$) are disclosed and studied. The dimorphism of $CaCrF_5$ and CrF_3 is established. (17 refs.)

Specific volume diagrams for ceramic processing ....See Entry 73044

81.30F Solidification

(see also 64.70D Solid-liquid transitions)

73075 Some physical aspects of unidirectional crystallisation in microgravity. V.S.Avduyevsky, S.D.Grishin, L.V.Lescov (Intercosmos Council, Acad. of Sci., Moscow, USSR).
Acta Astronaut. (GB), vol.9, no.9, p.583-8 (Sept. 1982). [received: March 1983]
Deals with the analysis of physical features of ingot fabrication with the aid of a unidirectional crystallisation method in microgravity. Conditions were investigated under which the main contribution to the process of heat and mass transfer in the melt would be made by the convection induced by the Marangoni effect. To estimate the thickness of typical boundary layers and the current rate values analytical correlations have been obtained. The effect of heat exchange features in the melt on the crystallisation front rate value has been treated. To demonstrate experimentally the unidirectional crystallisation of germanium in space the distribution of alloying admixtures has been calculated and the distribution density estimates have been made. (12 refs.)

73076 Microsegregation and extended solid solutions after rapid solidification of aluminium alloys. L.Katgerman (Lab. for Metall., Delft Univ. of Technol., Delft, Netherlands).
Scr. Metall. (USA), vol.17, no.4, p.537-40 (April 1983).
A criterion for segregation cellular solidification is formulated, based on the thermodynamic requirement in combination with a kinetic approach of the solidification process. This treatment results in more realistic values for the critical solidification rate for complete solid solutions and in predictions of extended solid solubilities as a function of solidification rate. (17 refs.)

73077 Formation and stability of extended solid solutions made by rapid quenching from the melt. H.Jones (Dept. of Metall., Univ. of Sheffield, Sheffield, England).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.71-7
Extension of solid solubility by rapid quenching from the melt (RQM) enormously increases the scope for alloy development in metals such as aluminium for which solid solubility is particularly limited under equilibrium conditions. The author mainly reviews recent work concerned with matching of experimental observations with predictions affecting: (1) conditions for solidification without change in composition, (2) temperatures and modes of decomposition on subsequent heating, and (3) hardening effects as-quenched and on heat treatment. The significance of such findings for bulk production and consolidation of wrought products for engineering applications is briefly discussed. (40 refs.)

73078 Rapid solidification of metastable materials. H.Liebermann, J.Walter (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.111-22
There are numerous processing methods available for the fabrication of rapidly-solidified metastable alloys. Examples include splat quenching, melt-spinning, surface melting and quenching, melt atomization and solidification, and deposition by sputtering and evaporation. Experimental aspects of each of these fabrication methods are discussed. These include solidification and quench rate, process control, and final product morphology and microstructure. Some properties of an amorphous alloy prepared by several of these processing methods are discussed. (102 refs.)

73079 Rapid solidification—mechanisms, morphology and microstructure. J.A.Domingue, W.J.Boesch (Special Metals Corp., New Hartford, NY, USA), J.F.Radavich, K.O.Yu.
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.161-5
Two nickel base disk alloys, Rene' 95 (R-95) and Inconel 100 (IN-100) were studied. The R-95 was manufactured by argon gas atomization (AA) and by centrifugal or spinning cup atomization (CA). AA IN-100 from SMC was studied as was IN-100 manufactured by an advanced rapid solidification rate (RSR) technique. V-60, a nickel base plasma spray hard facing alloy, manufactured by water atomization (WA), was also studied. Noticeable differences are observed between RSR and AA superalloy powders, but secondary dendrite arm spacing, thermograms and density become more similar as particle size decreases into the range normally used for further processing. (6 refs.)

Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting ....See Entry 69790

Glass-forming ability of the melt-quenched $(Fe_{1-y}Ni_y)_3B$ alloys ....See Entry 71883

Growth kinetic limitations during rapid solidification ....See Entry 72088

Ostwald ripening in two phase mixtures with application to rapid solidification ....See Entry 72128

Influence of solidification parameters on the microstructure of rapidly quenched Fe-Ni-B alloys ....See Entry 72131

Control over the structure of hard metals and other heterophase materials produced by liquid-phase sintering. I. Liquid-phase migration and general principles of sintering of 'skeletonless' alloys ....See Entry 73020

The modeling of rapidly solidified powders ....See Entry 73023

An automated laboratory apparatus for the production of rapidly solidified submicron powders ....See Entry 73024

Analysis of in situ rapid solidification of submicron Al-Ge eutectic powders using transmission electron microscopy ....See Entry 73025

Cooling rates and fine microstructures of RSR and argon atomized superalloy powders ....See Entry 73033

Casting of laminated ribbon using a modified melt-spinning technique ....See Entry 73035

Microsegregation of an aluminum and magnesium alloy at high solidification rates ....See Entry 73094

Comparison of the quench rates attained in gas atomized powders and melt-spun ribbons of Co and Ni base superalloys: influence on resulting microstructures ....See Entry 73118

Influence of the type of solidification of a cast nickel alloy of the ZhS6 family on its high temperature strength ....See Entry 73211

81.30H Constant-composition solid-solid phase transformations: polymorphic, massive, and order-disorder

(see also 64.70K Solid-solid transitions)

73080 High-temperature X-ray investigation of conversion of cementite into austenite. V.M.Ershov (Mining-Metall. Inst., Kommunar, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.605-7 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A special high-temperature X-ray method was developed for a detailed study of the process of conversion in some pure metals (Fe, Ni, Co, Ti) containing embedded silicon carbide (cementite) particles. Heating caused conversion of the carbide phase to austenite and at elevated temperatures (above 500°C) the metastable austenite became saturated with the alloying element (for example, nickel) and was thus stabilized. (3 refs.) *A.T.*

73081 Considerations of solute-drag in relation to transformations in steels. H.K.D.H.Bhadeshia (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
J. Mater. Sci. (GB), vol.18, no.5, p.1473-81 (May 1983).
In recent years, solute-drag theory has been widely quoted to explain apparent discrepancies in kinetic measurements of transformations in steels. Since conventional impurity drag theory is concerned solely with drag at grain boundaries, many new, or 'special' drag models have been developed to apply at interphase interfaces. An assessment is made of these special drag theories, and of the experimental evidence claimed in their support. It is found that our understanding of solute-drag at interphase interfaces is very weak, and that the experimental evidence for the existence of solute drag at transformation interfaces in steels is very doubtful. (58 refs.)

Hot-pressed silicon nitride with a small amount of MgO added ....See Entry 73039

Influence of two-stage ageing on structural transitions in β-zirconium alloys ....See Entry 73086

81.30K Martensitic transformations

(see also 64.70K Solid-solid transitions)

73082 Influence of hydrogen on the temperature of a thermoelastic martensitic transformation in titanium nickelide. I.A.Stepanov, Yu.M.Flomenblit, V.A.Zaimovskii (All-Union Interdisciplinary Sci.-Res. Inst. on Protection of Metals from Corrosion, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.612-14 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Samples were subjected to electrochemical hydrogenation in a 4% solution of sulphuric acid. The temperature of the investigated transformation rose to a maximum and then fell as the hydrogenation treatment was continued. The results also depended on the current density during the hydrogenation treatment. (5 refs.) *A.T.*

73083 A transformation anomaly in a Cu-Zn-Al alloy. W.M.Stobbs (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
J. Microsc. (GB), vol.129, pt.3, p.307-14 (March 1983). (MICRO 82: High Resolution Electron Microscopy, London, England, 12-16 July 1982).
A comparison is described of the structures of an M9R Cu-Zn-Al alloy as quenched directly into the martensitic state, and as stabilized, with the structure of the material after up-quenching into the β_1 state after which treatment the martensitic memory transformation occurs thermoelastically. Preliminary results on the increased tendency for the stabilized alloy to form FCC stacking sequence regions are given and discussed. (5 refs.)

73084 Characteristic martensitic transformation of the Fe-Pt disordered alloys around the γ-α phase boundary. K.Sumiyama, M.Shiga, Y.Nakamura (Dept. of Metal Sci. & Technol., Kyoto Univ., Kyoto, Japan).
Phys. Status Solidi a (Germany), vol.76, no.2, p.747-51 (16 April 1983).
Magnetization and thermal expansion are measured for Fe-26 and 27 at.% Pt disordered alloys. A martensitic transformation with a large hysteresis is detected for the Fe-26 at.% Pt disordered alloy, whose M_s temperature is just below the Curie temperature of the FCC phase. On the other hand, a martensitic transformation with a small hysteresis, which can be classified as a thermoelastic transformation, is observed for the Fe-27 at.% Pt disordered alloy, whose M_s temperature is much lower than the Curie temperature of the FCC phase. Since the positive volume magnetostriction (Invar effect) becomes large above the M_s temperature for the Fe-27 at.% disordered alloy, it may play an important role in determining favourable conditions for the thermoelastic martensite transformation in the Fe-Pt alloys. (16 refs.)

Magnetostriction of austenite in iron-nickel-manganese alloys and martensitic transition under the action of a strong magnetic field ....See Entry 72649

Analysis of the characteristics of lumped deformation of heterophase crystalline materials ....See Entry 73135

Plastic deformation of a metastable stainless steel at low temperatures ....See Entry 73161

81.30M Precipitation

(inc. segregation; see also 64.75 Solubility, segregation and mixing)

73085 Investigation of coalescence processes in Al-2.8% Li alloy. A.L.Berezina, L.N.Trofimova, K.V.Chuistov (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.543-7 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Kinetics of precipitation of Al-2.8% Li alloy after quenching to the ageing temperature was investigated by an analysis of the evolution of the particle size distribution curve. The growth of the average particle size was described by a cubic function of time. The form of the distribution curves corresponded, as indicated by a check against the Pearson criterion, to the theoretical Lifshiftz-Slezov distribution. The activation energy of the process of coalescence of the δ'-phase ($Q=-117$ kJ/mole) was determined and the surface energy of coherent particles of the δ'-phase was found ($\gamma=0.087$ J/m^2). (14 refs.) *A.T.*

73086 Influence of two-stage ageing on structural transitions in β-zirconium alloys. M.I.Zakharova, V.B.Vasil'eva (M.V. Lomonosov State Univ., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.619-22 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An investigation was made of the influence of two-stage ageing on the precipitation of the b.c.c. β solid solution in zirconium alloys with the compositions 74% Zr, 14% Nb, 12% Mo or 68% Zr, 23.3% Nb, 8.5% Mo (all atomic percent). X-ray structure analysis and diffraction electron microscopy were used in this study. Various precipitation processes were observed in the two alloys. (2 refs.) *A.T.*

73087 The precipitation of tungsten hemi-carbide (W_2C) in tungsten wafers. T.Epicier, C.Esnouf (Inst. Nat. des Sci. Appliquees, Villeurbanne, France).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L31-3 (April 1983). In French.
The communication reports the results of work in which tungsten wafers (25×4×0.3 mm), made by electrolytic polishing and ionic bombardment were carburised by being surrounded by graphite pellets at 2000°-2100°C for several minutes, the amount of carbon so introduced varying from 1 per thousand to several percent (atomic). The reported observations confirm previous results on the precipitation of the hexagonal phase of Me_2C obtained by transmission electron microscopic observation of a variety of metals. Illustrated are the appearance of an incoherent precipitate, surrounded by helical dislocations and the presence of the W_2C phase together with its orientation in the matrix, all being consistent with the relations found by Burgers. Successive stages of the precipitation were observed qualitatively in different specimens, all suggesting that the precipitation of the W_2C in the tungsten operates in the same way as in other systems of transition metal and carbon. Further work is required to clear up some finer points concerning deviation of axes. (11 refs.) *C.J.O.G.*

73088 The kinetics of σ-phase precipitation in AISI 310 and AISI 316 steels. J.Barcik (Inst. of Phys. & Chem. of Metals, Silesian Univ., Katowice, Poland).
Metall. Trans. A (USA), vol.14A, no.4, p.635-41 (April 1983).
The kinetics of σ-phase precipitation in AISI 310 and AISI 316 steels were studied. An attempt was made to express the rate of precipitation of σ-phase with formal kinetic theory equations. It was established that rate of precipitation of σ-phase is a function of temperature that agrees with the Johnson-Mehl equation. (24 refs.)

73089 Segregation to interphase boundaries in liquid-phase sintered tungsten alloys. C.Lea (Div. of Materials Applications, NPL, Teddington, England), B.C.Muddle, D.V.Edmonds.
Metall. Trans. A (USA), vol.14A, no.4, p.667-77 (April 1983).
Scanning Auger electron spectroscopy has been used to examine the distribution of impurity elements on the fracture surfaces of liquid-phase sintered W-Ni-Cu and W-Ni-Fe alloys. On the interphase boundaries between the FCC Ni-based matrix phase and the tungsten particles, segregation levels of ~0.4 and ~0.2 monolayers of phosphorus have been observed in as-sintered, furnace-cooled specimens of W-Ni-Cu and W-Ni-Fe, respectively. The phosphorus is homogeneously distributed but at fracture adheres preferentially to the matrix phase. High temperature heat treatment (1350°C) followed by water quenching reduces significantly the phosphorus segregation and improves the degree of cohesion across these boundaries. Segregated sulfur is detected on both sides of the interphase boundaries after fracture. The sulfur is much less uniformly distributed than the phosphorus, and its segregation level increases in the heat treated specimens. Copper also segregates to the interphase boundaries during the heat treatment of W-Ni-Cu specimens, but no equivalent segregation of iron was observed in the W-Ni-Fe system. The boundaries developed between adjacent tungsten particles are free of impurity contamination in both alloy systems but have a segregated layer of nickel. (25 refs.)

73090 High-resolution electron microscopy study of a Ti-1.6 at.% N alloy. D.Sundararaman, A.L.E.Terrance (Reactor Res. Centre, Kalpakkam, India), G.van Tendeloo, J.van Landuyt.
Phys. Status Solidi a (Germany), vol.76, no.2, p.K109-11 (16 April 1983).
Direct lattice imaging with a high-resolution TEM is a powerful technique for complementing crystal structure determination and specifically suited to the study of mixed structures. The authors present a high-resolution electron microscopy study of the ordered zones (α') that are present in the supersaturated α''(HCP) and its subsequent transformation on ageing to Ti_2N precipitates. (4 refs.)

73091 The sequence of phases in Al-Cu alloys. T.B.Wu (Dept. of Materials Sci. & Engng., Nat. Tsing Hua Univ., Hsinchu, Taiwan), E.Matsubara, J.B.Cohen.
Scr. Metall. (USA), vol.17, no.4, p.559-62 (April 1983).
The approach to equilibrium upon ageing of Al-Cu alloys is studied by X-ray diffraction. The sequence of phases are identified. Guinier-Preston zones I and II are observed from the diffraction peaks. A mechanism is discussed in terms of the elastic energy of a solid solution. Phonon dispersion curves are illustrated. (10 refs.)

73092 Some aspects of micro-alloying. R.W.K.Honeycombe (Univ. of Cambridge, Cambridge, England).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.177-89 (April 1983).
The various basic roles of micro-alloying additions are examined within a framework which emphasizes their modes of distribution in alloys. The effects of solute atoms when segregated to vacancies, dislocations and grain boundaries are briefly reviewed. The formation of precipitates involving micro-additions are shown to influence markedly the behaviour of many alloys. Examples are given of the effects of solute atoms in the nucleation and growth of phases in both ferrous and non-ferrous alloys. Another important

field is illustrated by the control of grain growth and recrystallization by micro-alloying additions to achieve ultra-fine grain sizes, for example in aluminium alloys to obtain superplastic behaviour, and in HSLA steels to obtain high strength and toughness. Some examples are also given of the effects of micro-alloying in phase transformations, particularly nucleation of precipitates at interphase boundaries. Finally, some beneficial effects of minor additions made to creep-resistant nickel-base and Cr-Ni austenitic alloys are discussed. (31 refs.)

73093 Defect interactions in 'solar' silicon. D.Helmreich, H.Seiter (Heliotronic, Burghausen, Germany), D.Huber, R.Wahlich.
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.405-10
In poly-Si the appearance of SiC and SiO_x precipitates is correlated with the thermal history and the carbon and oxygen content. Oxygen precipitation seems to play a distinct role in the formation of denuded zones along high-energy incoherent grain boundaries. EBIC studies on zones of this kind show unusual electrical behaviour that will be investigated further. (26 refs.)

73094 Microsegregation of an aluminum and magnesium alloy at high solidification rates. L.J.Masur, J.T.Burke, T.Z.Kattamis, M.C.Flemings (MIT, Cambridge, MA, USA).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.185-9
Results are presented of an on-going study of structure and solute redistribution in ribbon cast Al-Cu and Mg-Zn alloys. Regions found in these ribbons are (1) an apparently chemically homogeneous coarse-grained zone adjacent to the chill, (2) a transition cellular region, and (3) a dendritic zone, usually equiaxed. In both alloys, structure in the equiaxed region becomes coarser with increasing distance from the chill. In Mg-Zn alloys, the amount of nonequilibrium second phase increases essentially linearly with distance in the cellular and dendritic regions. Scanning transmission electron microscopy can accurately measure solute distribution across rapidly solidified cells or dendrites, but the possibility of surface compositional changes during specimen preparation must be recognized. (7 refs.)

On calculated energies of segregation, grain boundary energies and lattice energy functions .... See Entry 71976

Irradiation induced precipitation in tungsten based, W-Re alloys .... See Entry 72018

On the temperature of phase dissolution in real crystals .... See Entry 72115

Ostwald ripening in two phase mixtures with application to rapid solidification .... See Entry 72128

High temperature internal oxidation behaviour of dilute Ni-Al alloys .... See Entry 72166

Grain-boundary diffusion in metals .... See Entry 72170

Investigation of phase stability in the system SiC-AlN .... See Entry 73043

Microsegregation and extended solid solutions after rapid solidification of aluminium alloys .... See Entry 73076

Considerations of solute-drag in relation to transformations in steels .... See Entry 73081

Modification of the spinodal hardening in a Cu-9 wt.% Ni-6 wt.% Sn alloy by 0.1 wt.% silicon or aluminium addition .... See Entry 73098

Effect of preceding heat treatments on the process of quench ageing in Fe-N alloys .... See Entry 73101

Effect of precipitates formed during pre-ageing on the process of quench ageing in Fe-N alloy .... See Entry 73102

Transmission electron microscopy of an annealed and nitrided Fe-600 wt.ppm Ti alloy .... See Entry 73116

Role of grain boundary segregation in diffusional creep .... See Entry 73144

Crack and cavity nucleation at interfaces during creep .... See Entry 73145

The effects of segregation on the kinetics of intergranular cavity growth under creep conditions .... See Entry 73146

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures .... See Entry 73147

High temperature embrittlement of Ni and Ni-Cr alloys by trace elements .... See Entry 73198

Sensitization of austenitic stainless steels. II. Commercial purity alloys .... See Entry 73264

81.40 TREATMENT OF MATERIALS AND ITS EFFECTS ON MICROSTRUCTURES AND PROPERTIES

73095 A comparison of probabilistic techniques for the strength of fibrous materials under local load-sharing among fibers. S.L.Phoenix (Sibley School of Mech. & Aerospace Engng., Cornell Univ., Ithaca, NY, USA), R.L.Smith.
Int. J. Solids & Struct. (GB), vol.19, no.6, p.479-96 (1983).
Compares three distinct asymptotic analyses for the probability distribution for strength of a certain class of fibrous materials. This class, which contains composite materials and twisted yarns and cables, is characterized by strong, mechanical interaction among neighboring fibers as is generated by a binding matrix or by transverse frictional forces. The model is the chain-of-bundles model, and the authors focus mainly on a planar geometry and a simple type of local load-sharing among fibers in a cross-section wherein the load of a failed fiber is shifted in equal portions to its two nearest flanking survivors. Through the study of typical examples the authors find that the results of the three methods all underscore the importance of the Weibull distribution for modeling composite strength, and are in excellent numerical agreement despite their differing analytical form. This is fortunate because only the two least accurate of the analysis show promise of being extended to more general three-dimensional geometries and local load-sharing rules of interest in applications. (19 refs.)

73096 Effect of silane coupling agents on mechanical and thermal properties of polyester resin concrete. P.Mani, A.K.Gupta, S.Krishnamoorthy (Centre for Materials Sci. & Technol., Indian Inst. of Technol., New Delhi, India).
J. Mater. Sci. (GB), vol.18, no.5, p.1506-14 (May 1983).
Polyester resin-quartzite aggregate composites have been investigated for the effect of two silane coupling agents (γ-aminopropyl triethoxy silane and γ-methacryloxy propyl trimethoxy silane) on the mechanical and thermal properties. The integral blend additive method of application of the coupling agent was used in the preparation of the samples. Variation of the thermal stability and the compressive strength with the nature and the content of the silane coupling agent were quite consistent. The properties showed maxima around a certain value of the coupling agent content, which is suggested as the optimum value. Results are also presented on the samples containing an additional filler, namely, the $CaCO_3$. (10 refs.)

73097 A rational method for calculating mechanism maps. J.K.McCoy (Battelle, Columbus Labs., Columbus, OH, USA).
Scr. Metall. (USA), vol.17, no.4, p.563-8 (April 1983).
Methods for the systematic calculation and plotting of mechanism maps are described. It is discussed in terms of deformation modelling but the methods may be applied to other problems. The first step in the construction of the map is to divide the map into regions of dominance of mechanism. The second step is to find a set of contour lines for each of the regions. The third step is to plot the boundaries of the regions and the contours in a smooth and efficient manner. Examples are presented which illustrate the efficiency of the algorithm. (12 refs.)

The effect of some additives on electroless copper deposition ..See Entry 73007

81.40C Solid solution hardening, precipitation hardening, dispersion hardening

73098 Modification of the spinodal hardening in a Cu-9 wt.% Ni-6 wt.% Sn alloy by 0.1 wt.% silicon or aluminium addition. Ja'Afar Hadi Abboud, E.S.Dwarakadasa (School of Production Engng. & Metall., Univ. of Technol., Baghdad, Iraq).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.233-5 (May 1983).
An attempt was made to study the influence of adding a small amount of a quaternary element to a high strength Cu-Ni-Sn alloy on the nature of thermal hardening that occurs due to a spinodal decomposition process. A positive trend was observed in terms of the stabilisation of the precipitate structure and absence of softening on long ageing. (4 refs.)

73099 Features of heat treatment of sintered type M5F5 fast-cutting steels. G.G.Mukhin, V.A.Korotkova, V.A.Borisova.
Izv. VUZ Mashinostr. (USSR), no.3, p.148-51 (1983). In Russian.
Examines changes in the phase composition of type M5F5 sintered fast-cutting steels, during hardening and tempering. Using metallographic, X-ray and carbide methods of analysis, changes in the grain dimensions, and in the amount of the residual austenite and carbides have been studied. It was found that the primary type MC and M_6C carbides in sintered steels differ from the corresponding carbides of cast steel. It was also established that the small-grain austenite structure in sintered steels is preserved right up to the start of partial melting; for this reason, the main parameter to choose for optimisation should be hardness and not grain number. (6 refs.) *Z.F.V.*

73100 Strengthening of polyphase Si_3N_4 materials through oxidation. F.F.Lange, B.I.Davis, M.G.Metcalf (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
J. Mater. Sci. (GB), vol.18, no.5, p.1497-505 (May 1983).
Specimens of various polyphase Si_3N_4 materials fabricated in the Si-Mg-O-N system, and a commercial Si_3N_4 material were subjected to oxidation treatments prior to flexural strength determinations at 1400°C. It was demonstrated that a pre-oxidation treatment could significantly improve the high-temperature strength. The compositional change induced by oxidation which can decrease the volume fraction of the viscous phase present in these materials at high temperatures is believed to be responsible for the observed strengthening. (15 refs.)

73101 Effect of preceding heat treatments on the process of quench ageing in Fe-N alloys. M.Ichimura, M.Imabayashi.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.113-19 (1982). In Japanese.
The authors examine the influences of quenching temperatures (800°C, 580°C, 400°C), a reversion treatment (250°C) and pre-ageing treatments (300°C, 200°C, 50°C) on a process of metastable nitride precipitation at 100°C. A precipitation of nitride from a supersaturated solid solution of α Fe is studied by an internal friction method. The precipitation process at 100°C is practically unaffected by the changes in quenching temperature and by the reversion treatment. On the other hand, the precipitation of nitride is accelerated remarkably by the pre-ageing treatments and the rate of acceleration increased with decreasing the pre-ageing temperature. (14 refs.)

73102 Effect of precipitates formed during pre-ageing on the process of quench ageing in Fe-N alloy. M.Ichimura, M.Imabayashi.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.121-6 (1982). In Japanese.
The authors obtained the ageing temperature dependence of the rate of metastable nitride precipitation and the apparent activation energy for precipitation of metastable nitride at 50 to 180°C after pre-ageing at 50°C, 200°C and 300°C. The reason for the effect of precipitates formed by pre-ageing on the precipitation process of metastable nitride was discussed. Except for ageing at higher temperature than 150°C, the precipitation process of metastable nitride was accelerated by pre-ageing and the rate of acceleration was increased with falling of pre-ageing or ageing temperature. (7 refs.)

Coherency strain fields: magnitude and symmetry .... See Entry 71846

Study of the swelling of an Al-Ar-O alloy by an acoustic emission method .... See Entry 72142

Production, properties, and possible application of dispersion hardened copper .... See Entry 73034

The use of acoustic emission techniques to monitor fracture processes in high strength precipitation hardened aluminum alloys .... See Entry 73168

Comment on 'Toughening of glasses by metallic particles' [and reply] .... See Entry 73189

The interaction of dislocation with Θ'-precipitates in a Al-2.8% Cu-alloy during fatigue tests .... See Entry 73215

81.40E Cold working, work hardening; annealing, recovery and recrystallisation; textures

73103 Hardenability of a high-purity 0.3% Mo eutectoid steel. H.I.Malik (Coll. of Engng. & Petroleum, Univ. of Kuwait, Safat, Kuwait).
Arch. Eisenhuettenwes. (Germany), vol.54, no.3, p.123-4 (March 1983).
The hardenability in 0.3% Mo and 0% Mo steels of eutectoid compositions is determined using quantitative standard methods. There is a slight effect on the Ae_1 temperature, but an increase of the incubation period and the completion of austenite decomposition to pearlite by the addition of 0.3% Mo. There is evidence from Jominy end quench tests that the addition of molybdenum increases the hardenability of steel. (3 refs.)

73104 Strain hardening representation for implicit quasistatic elasto-viscoplastic algorithms. J.M.M.C.Marques (Dept. of Civil Engng., Univ. of Oporto, Oporto, Portugal), D.R.J.Owen.
Comput. & Struct. (GB), vol.17, no.2, p.301-4 (1983).
Time integration processes for the solution of elasto-viscoplastic problems are briefly reviewed. For materials that strain harden, additional terms, which arise from the variation in yield level occurring during a time increment, are included in the expression of the viscoplastic strain rate. The influence of these additional terms is discussed and illustrated by the solution of numerical examples. (6 refs.)

73105 Influence of V and Zr on the rolling texture, recrystallization, and anisotropy of the Young modulus of Ti-V and Ti-Zr alloys. I.G.Zakharchenko, V.V.Nemoshkalenko, V.S.Kshnyakin (K.D. Ushinski Pedagogical Inst., Odessa, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.533-7 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The pole figure method was used to study the formation of the cold rolling texture and changes in the preferential orientation resulting from heat treatment of various Ti-V and Ti-Zr alloys. An estimate was obtained of the anisotropy of the Young modulus. Cold rolling produced a one-component texture, but when the concentration of Zr was in excess of 45%, the texture had two components. Refinement of the texture and an increase in the anisotropy of the Young modulus as a result of annealing were attributed to active polygonization processes. (6 refs.) *A.T.*

73106 Effect of zinc content on the annealing behaviour of deformed alpha-brasses. T.H.Youssef (Metal Phys. Unit., Nat. Res. Centre, Cairo, Egypt), M.A.Kenawy, F.A.Saadalah, M.B.Zikry.
Fizika (Yugoslavia), vol.15, no.1, p.1-9 (Jan.-March 1983).
Hardness measurements, metallographic observations, as well as X-ray diffraction patterns were used to study the annealing of deformed four alpha-brasses of zinc content 3.5, 8.8, 19.4 and 26.8 weight percent. The relaxation spectrum for each alloy was characterized by the presence of three annealing stages. The first one was attributed to the annealing out of vacancies and relative free dislocations. The second annealing stage, observed at higher annealing temperature, was attributed to recrystallization mechanism which takes place by self-diffusion. At much higher temperatures, grain growth mechanism was responsible for the third annealing stage. Increasing zinc content was found to help the annealing mechanisms, as it increases the rate of vacancy diffusion in the matrix, moreover it facilitates slip reactions. This increase takes place in two rates, high rate in alloys of low zinc content, and relative lower rate in alloys of high zinc content. (17 refs.)

73107 Effect of rollers on surface roughness anisotropy of thin-sheet steel. M.F.Sukhov, A.A.Zyuzin, A.M.Kozlov, E.I.Bulatnikov.
Izv. VUZ Mashinostr. (USSR), no.3, p.122-5 (1983). In Russian.
Measurements show that side roughness of working rollers of mills for cold rolling of steel has a dominant effect on the anisotropy of the surface roughness of the steel. The intersecting surface microroughness of strips of electrotechnical steel, with the irregularities inclined at 45 degrees to the rolling direction, exhibits a near-isotropic distribution of the roughness parameters, and has better adhesiveness with an electrically-insulating coating. Measures for improving the surface microroughness of cold rolled steel strips are discussed. (no refs.) *Z.F.V.*

73108 Numerical determination of the parameters of Krupkowski's function for a torsion test taking into consideration the strain hardening ranges. A.Grabianowski (Inst. for Metal Res., Polish Acad. of Sci., Krakow, Poland), J.Kloch.
J. Mater. Sci. (GB), vol.18, no.5, p.1323-30 (May 1983).
A method has been proposed (see A. Krupkowski, Bull. Acad. Sci. Ser. Sci. Tech., vol.17, p.67, 1969) for determining the parameters of a function describing the strain hardening curve for a torsion test taking into consideration the strain hardening ranges. Certain measures for the approximation quantity have been defined by means of which it is possible to formulate the criterion of the occurrence of these ranges. Experimental verification of the method was carried out using nickel of 99.95% purity. Test pieces of a circular cross-section were subjected to a torsion test at ambient temperature without taking into consideration the strain hardening rate. (9 refs.)

73109 A study on the effects of intermediate annealing in 3% single oriented silicon steel. Bong Hee Hahn (Coll. of Engng., Seoul Nat. Univ., Seoul, Korea), Hee Kyong Moon.
J. Korean Inst. Met., vol.21, no.1, p.7-13 (Jan. 1983). In Korean.
The effects of the intermediate annealing in the two stage cold rolling of 3% Si steel on the secondary recrystallization have been studied. When the conditions are excessive (1000°C for longer than 10 min, 1100°C for longer than 5 min), the (110) [001] component is so dominating that it subsequently prevails in the primary recrystallized grains. Hence the grains are small after high temperature annealing. When the conditions are insufficient (700°C for shorter than 5 min, 800°C for shorter than 2 min), the rolling texture (112) [110] considerably remains. After rolling this component rotates into (111) [110] which remains very strong in primary grains. Hence the secondary recrystallization is incomplete. In compromising conditions the relevant proportion of (110) and (111) in the primary grains is obtained, which results in good secondary recrystallization behavior. (7 refs.)

73110 A study on the development of oriented 3% silicon steel. D.Y.Won, H.K.Lee, H.B.Im, J.T.Kim, K.Lee, C.W.Kim.
J. Korean Inst. Met., vol.21, no.1, p.14-18 (Jan. 1983). In Korean.
A study on the development of boron 3% silicon-iron containing 0.03/0.04 C, 0.07/0.08 Mn and boron (30 ppm add) was carried out. Samples prepared by two stage cold reduction method developed complete secondary recrystallization, while samples prepared by one stage cold reduction method showed incomplete secondary recrystallization and poor magnetic properties. The magnetic properties also varied with normalizing temperature, and the sample prepared by normalizing at 950°C showed the best magnetic properties. The induction with a magnetizing force of 800 A/m was 1.86 tesla. (7 refs.)

73111 The texture in diffusion-grown layers of trialuminides $MeAl_2$(Me=Ti, V, Ta, Nb, Zr, Hf) and VNi_3. J.Maas, G.Bastin, F.van Loo, R.Metselaar (Lab. for Phys. Chem., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Z. Metallkd. (Germany), vol.74, no.5, p.294-9 (May 1983).
A series of intermetallic compounds was prepared with the $TiAl_3$ structure or related structures. The layers of the tri-aluminides formed in diffusion couples do not grow according to the parabolic law. Most of the diffusion-grown layers show a weak texture. Generally, a fibre texture parallel to the direction of diffusion, consisting of two components has been found together or separately in the same layer. In $NbAl_3$, VAl_3 and $TaAl_3$ the nature of the texture was a ⟨110⟩ and a ⟨100⟩ fibre texture. In $TiAl_3$ layers a ⟨100⟩ fibre texture has been found together with an exceptional component, a [001]-fibre texture, probably related to the formation of a superstructure In $HfAl_3$-layers grown on a Hf substrate with a sheet texture, the texture in the $HfAl_3$-layer was not rotationally symmetric around the direction of diffusion, but a related sheet texture developed. In the case of textureless Hf substrates the $HfAl_3$ layers exhibit a [001]-fan texture. In $VN1_3$- layers no texture was produced. (28 refs.)

The kinetics of structural relaxation in amorphous $Fe_{40}Ni_{40}P_{14}B_6$ .... See Entry 71902

Structure and properties of chromomanganese austenitic steels hardened by hydraulic extrusion .... See Entry 71971

Investigation of changes in the grain-boundary structure as a result of recrystallization of a magnesium alloy after weak deformation .... See Entry 71972

Crystallogeometric features of the subgrain structure and their relationship to the deformation texture .... See Entry 71973

Investigation of technical-grade beryllium by the Mossbauer effect method .... See Entry 72717

Effect of composition of powder mixtures and rolling temperature on the compactibility and properties of strip .... See Entry 73027

Link between stress and strain of initially anisotropic materials with anisotropic strain hardening .... See Entry 73159

Subsurface plastic deformation in machining 6Al-2Sn-4Zr-2Mo titanium alloy .... See Entry 73163

The enhancement of hydrogen attack in steel by prior deformation .... See Entry 73200

The corrosion behavior of AISI 304L stainless steel in 0.1 M HCl at room temperature. II. The effect of cold working .... See Entry 73261

Measurement of visual information with texture analysis. II ... See Entry 73295

81.40G Other heat and thermomechanical treatments

73112 The sintering of creep-induced cavities in a low-alloy ferritic steel (1Cr1Mo0.75V). R.A.Stevens, P.E.J.Flewitt (Sci. Services Dept., CEGB, Gravesend, England).
Metall. Trans. A (USA), vol.14A, no.4, p.679-86 (April 1983).
Sintering heat treatments at temperatures in the range of 1173 to 1273K have been undertaken in an atmospheric pressure of argon gas to remove grain boundary cavities within a 1Cr1Mo0.75V ferritic steel (Durehete 1055) following creep rupture after service operation at 838K. High sensitivity density measurements and optical metallography have been used to monitor the progressive sintering of cavities. The results are discussed in relation to existing models which describe the sintering of cavities by grain boundary diffusion. (25 refs.)

73113 Behaviour of titanium alloy Ti-6% Al-4% V in the range of hot heating.. J.G.Malcor, F.Montheillet (Ecole des Mines de Paris, Centre de Mises en Forme des Materiaux, Valbonne, France).
Mem. & Etud. Sci. Rev. Metall. (France), vol.80, no.2, p.89-101 (Feb. 1983). In French.
The results of hot torsion tests, between 800 and 1200°C and in the velocity range 5.10^{-3} to 5 s^{-1}, performed on two initial structures, either equiaxial or acicular, are presented. The behaviour rule of TA 6 V in the range of hot forging is determined. (14 refs.)

73114 The effect of the atmosphere of heat-treatment on the cobalt ions in the cobalt aluminumoxides with the spinel structure. T.Yao, H.Jinno (Dept. of Industrial Chem., Kyoto Univ., Kyoto-shi, Japan).
Yogyo-Kyokai-Shi (Japan), vol.91, no.3, p.131-6 (1983). In Japanese.
The effect of the atmosphere of heat-treatment on the valence and the coordination state of the cobalt ions were investigated. Cobalt carbonate and α-alumina were mixed in the equimolar ratio, and the mixture was heat-treated at 1400°C or 1300°C under various partial pressure of oxygen (P_{O2}) from 2.1×10^{-1} atm to 1.7×10^{-7} atm for the heat-treatment at 1400°C, and from 2.1×10^{-1} atm to 1.1×10^{-8} atm at 1300°C. The lattice constants and the photoacoustic spectra (PAS) of the samples were measured. The lattice constants were scarcely changed with temperature and oxygen partial pressure of the heat-treatment (Table 1). In the PAS of the samples heat-treated in low P_{O2} region, only the peak corresponding to the $^4A_2(F) \rightarrow {}^4T_1(P)$ transition of Co^{2+} ions in the tetrahedral sites was observed. Onthe samples heat-teated in high P_{O2} region, however, additional peaks were observed, corresponding to the $^4T_{1g}(F) \rightarrow {}^4T_{1g}(P)$ transition of Co^{2+} ions in the octahedral sites and also to the $^1A_{1g}(D) \rightarrow {}^1T_{2g}(D)$ and $^1A_{1g}(D) \rightarrow {}^1T_{1g}(D)$ transitions of Co^{3+} ions in the octahedral sites. (33 refs.)

73115 Control of microstructures of (α+β)-titanium alloys. M.Peters (Inst. fur Werkstoffe, Ruhr-Univ. Bochum, Bochum, Germany).
Z. Metallkd. (Germany), vol.74, no.5, p.274-82 (May 1983).
Commercial (α+β)-titanium alloys are generally classified into three microstructural groups according to the geometrical arrangement of the two phases α and β: lamellar, equiaxed, and a mixture of both which is therefore called bi-modal. Lamellar structures are readily controlled by heat treatments. In contrast equiaxed and bi-modal structures require additional deformation procedures because they are established by recrystallization. The parameters which control their homogeneity are the deformation and recrystallization conditions as well as the starting structure before deformation. The finest equiaxed microstructures achieved had α grain sizes of about 2 μm. (36 refs.)

73116 Transmission electron microscopy of an annealed and nitrided Fe-600 wt.ppm Ti alloy. M.Foldeaki, M.Rapp, H.Kronmuller (Max-Planck-Inst. fur Metallforschung, Inst. fur Phys., Stuttgart, Germany).
Z. Metallkd. (Germany), vol.74, no.5, p.283-8 (May 1983).
Systematic investigations of the microstructure of a Fe-600 wt.ppm Ti alloy have been carried out with regard to different annealing and nitriding treatments. The structure controlling factor of both treatments is the annealing temperature which influences the precipitation and nucleation behaviour of Ti itself (annealing) as well as the formation of TiN (nitriding). (16 refs.)

73117 On γ and γ′ phases composition in Ni-base superalloys after high-temperature exposure. M.Magrini, B.Badan, E.Ramous (Istituto di Chimica Industriale, Univ. di Padova, Padova, Italy).
Z. Metallkd. (Germany), vol.74, no.5, p.314-16 (May 1983).
The chemistry and volume fraction of γ′ phase in IN-100, UD-520 and UD-710 superalloys after high-temperature exposure in service have been examined. In the three alloys after exposure the γ composition remains nearly constant and the concentration of (Al+Ti) in γ′ phase increases, approaching the theoretical value of 25%. The results suggest that Cr, Mo and W aim to occupy different sites in the γ′ lattice in the three examined alloys. (13 refs.)

73118 Comparison of the quench rates attained in gas atomized powders and melt-spun ribbons of Co and Ni base superalloys: influence on resulting microstructures. F.Duflos, J.F.Stohr (ONERA, Chatillon, France).
Rapidly Solidified Amorphous and Crystalline Alloys. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.167-71
The cooling rates during solidification of gas atomized Stellite 6 (S6) powders range from 10^3 K/s to 10^6 K/s for 400 μm diameter powder particles respectively. The microstructures vary from equiaxed type in the coarser particles to fully dendritic, cellular and microcrystalline in the finer particles. In the case of melt spun ribbons, the variations in freezing rate along a cross section of the ribbon produce a change in the microstructure from microcrystalline at cooling rates greater than 10^7 K/s to cellular and finally dendritic at rates on the order of 10^6 K/s. (6 refs.)

Peak representing annealing of point defects and the activation energy of the process responsible for this peak ....See Entry 71956

Investigation of changes in the grain-boundary structure as a result of recrystallization of a magnesium alloy after weak deformation .... See Entry 71972

Influence of solidification parameters on the microstructure of rapidly quenched Fe-Ni-B alloys ....See Entry 72131

Integral emittance of niobium during high-temperature heating and oxidation ... .See Entry 72144

Spin glass behavior of some rapidly quenched iron (2+) aluminosilicates ....See Entry 72612

Changes in the magnetic properties of amorphous alloy $Fe_5Co_{70}Si_{15}B_{10}$ caused by thermomagnetic treatment and the dependence of these changes on the initial state of alloy .... See Entry 72630

Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy ....See Entry 72638

Structure formation in and magnetic properties of a P/M iron-chromium-cobalt alloy ....See Entry 72639

Effect of quenching rate and annealing on ESR of Cu^{2+} and γ-induced Cd^+ in low alkali borate glasses ....See Entry 72664

Effect of composition of powder mixtures and rolling temperature on the compactibility and properties of strip ....See Entry 73027

Formation and stability of extended solid solutions made by rapid quenching from the melt ....See Entry 73077

A transformation anomaly in a Cu-Zn-Al alloy ....See Entry 73083

Investigation of coalescence processes in Al-2.8% Li alloy ..... See Entry 73085

Influence of two-stage ageing on structural transitions in β-zirconium alloys ....See Entry 73086

Segregation to interphase boundaries in liquid-phase sintered tungsten alloys ....See Entry 73089

The sequence of phases in Al-Cu alloys ....See Entry 73091

Features of heat treatment of sintered type M5F5 fast-cutting steels ....See Entry 73099

Effect of preceding heat treatments on the process of quench ageing in Fe-N alloys .... See Entry 73101

Effect of precipitates formed during pre-ageing on the process of quench ageing in Fe-N alloy ....See Entry 73102

A study on the development of oriented 3% silicon steel ....See Entry 73110

Effect of vacuum-treatment on mechanical properties of W-Ni-Fe heavy alloy . ...See Entry 73139

Crack propagation of high strength steels in a gaseous hydrogen atmosphere ... .See Entry 73202

Effect of environmental factors on the magnitude of polarization developed in eutectoid prestressing steels .... See Entry 73283

A note on the effect of heat treatment on the magnesium alloy used as galvanic anode ....See Entry 73284

Influence of thermal treatments on the structure and stability of gelatin gels ....See Entry 73376

81.40J Elasticity and anelasticity

(see also 62.20D Elastic constants, 62.40 Anelasticity, internal friction, and mechanical resonances)

73119 The calculation of a composite cylindrical shell of steel and concrete. Wang Zhen-ming (Inst. of Mech., Acad. of Sinica, Beijing, China).
Acta Mech. Solida Sin. (China), no.3, p.409-20 (1981). In Chinese.
A composite cylindrical shell of steel and concrete for a large floating cover oil tank is used to investigate the stress analysis problem of a bilayer cylindrical shell under the action of liquid pressure, temperature difference and the contraction of concrete. An example of calculation of an oil tank of 2×10^5 M^3 is given to illustrate the advantages of this composite structure. (6 refs.)

73120 A new relationship of DC conductivity with loss modulus in PET. N.Chand (Polymer Sci. & Engng. Group, Nat. Chem. Lab., Pune, India).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.183-4 (May 1983).
An attempt has been made to correlate the DC conductivity (σ) with the dynamic loss modulus (E'') of polyethylene terephthalate (PET). An equation is derived of the form $\log(\sigma/RT) = -4.6 \log(E''/W) + C$ where R and C are constants, T is the temperature and W is the frequency. (5 refs.)

73121 The stiffness and modulus of elasticity of grey cast irons. L.Haenny, G.Zambelli (Dept. des Materiaux, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.239-42 (May 1983).
It is difficult to apply the concept of the modulus of elasticity in the case of a grey cast iron. Three parameters are defined to overcome this problem and it is shown that whatever the prestrain applied, the stress/strain curve of a work hardened grey cast iron remains similar and is only modified by a multiplying factor. (4 refs.)

73122 Cyclic stress relaxation of polycrystalline metals at elevated temperature. G.J.Weng (Dept. of Mech. & Materials Sci., Rutgers Univ., New Brunswick, NJ, USA).
Int. J. Solids & Struct. (GB), vol.19, no.6, p.541-51 (1983).
The influence of a relatively small, superimposed alternating strain on the relaxation behavior of structural metals is examined from the micromechanics standpoint, taking into account the nature of crystallographic slip in the grain and grain interactions. The initial mean strain is allowed to be sufficiently large to include both elastic and plastic components. To facilitate the evaluation of this instantly relaxed stress state Hill's self-consistent relation for an elastoplastic polycrystal is modified from its incremental to a total form for a monotonic straining process. The self-consistent relation previously derived for static relaxation of an elastic-creep medium is also extended to the dynamic condition, and for an elastic-plastic-creep medium. Together with a set of unified constitutive equations of slip systems, these self-consistent relations are used to determine the cyclic relaxation behavior of a 0.16% carbon steel at various strain amplitudes. The results are seen to be in close agreement with the experimental data, both showing that the relaxation mean stress could be greatly facilitated by the presence of a small strain amplitude. (16 refs.)

73123 Internal friction due to hysteretic dislocation motion in solid solution crystals. O.Boser (Philips Labs., Briarcliff Manor, NY, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2338-43 (May 1983).
In analogy to Rayleigh's law in magnetism a Rayleigh law of plastic deformation is defined to explain the amplitude dependent internal friction and the modulus defect in materials with high solute concentrations. The forces opposing dislocation motion in a solid solution crystal with high solute concentrations are described with the help of random functions. Using this statistical treatment it is possible to calculate the parameters of Rayleigh's law of plastic deformation and explain quantitatively the amplitude and concentration dependence of the internal friction and modulus defect in alpha brass. (17 refs.)

73124 Study on physical properties of cement paste and mortar at early age by ultrasonic pulse method. S.Kakuta (Akashi Technol. Coll., Akashi, Japan), T.Akashi.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.353, p.175-81 (Feb. 1983). In Japanese.
Describes the analytical results of the physical properties of cement paste and mortar aged at 20±2°C up to 3 hours or 24 hours. The ultrasonic method was applied to investigate the longitudinal and the transverse pulse propagation properties. The dynamic modulus of elasticity, the dynamic modulus of viscosity and the relaxation time of cement paste and mortar were calculated from the pulse velocity, the frequency and the attenuation constant, respectively, and they were found to be frequency dependent in this time period. The dynamic modulus of elasticity of cement paste changed from 10^7 to 10^9dyn/cm^2 depending upon the water cement ratio and the elapsed time, and the dynamic modulus of viscosity from 10 to 10^5 dyn.sec/cm^2, until the age of 3 hours. The dynamic shear modulus and the dynamic bulk modulus were calculated by the longitudinal and the transverse pulse velocities and the density of specimens. (7 refs.)

73125 Characteristics of expansive concrete under bi-axial restraint. K.Okada, M.Ohta (Faculty of Engng., Kyoto Univ., Kyoto, Japan), T.Nagafuchi, A.Yata, S.Tamai.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.353, p.182-7 (Feb. 1983). In Japanese.
The expansion characteristics of expansive concrete are greatly dependent upon the restraint condition of concrete itself. The restrained expansive strains of main (longitudinal) and lateral reinforcing steels embedded in expansive concrete as well as the relations between them were investigated experimentally and theoretically. Under biaxial restraint, the chemical prestressing in one direction due to the restraining steel reduces the expansion in another direction. By considering the poisson's effects, an equation was proposed. (3 refs.)

73126 Internal friction of palladium boron alloys. H.Brodowsky, J.Fleischhauer, M.Kayashima (Inst. fur Phys. Chem., Univ. Kiel, Kiel, Germany).
Scr. Metall. (USA), vol.17, no.4, p.541-3 (April 1983).
Internal friction peaks were observed for Pd-B_1 samples with 0.3 to 2%B. The temperature at which the damping factor Q^{-1} had its maximum varied between 200 and 217K for frequencies between 0.25 and 11 cps. (10 refs.)

73127 Effect of some force factors on the rigidity characteristics of a magnesium-boron fiber composite material. A.F.Voitenko, V.K.Samarin, A.I.Gordienko (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.715-17 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.39-42 (Sept. 1982). [received: March 1983]
Values of moduli of rigidity of a fiber-reinforced composite calculated in accordance with the mixture rules surpass those determined by experiment. In order to allow correctly for rigidity, in design calculations it is necessary to employ values found in experiments involving given modes of loading and load levels. In assessments of the reliability and useful life of structural elements made of reinforced composite materials allowance must be made for the fact that cyclic loading alters the rigidity of such materials. (7 refs.)

73128 The shape of stress relaxation curves and the mechanical equation of state in molybdenum. K.Tanoue (Dept. of Metal Processing Engng., Kyushu Inst. of Technol., Kitakyushu, Japan), O.Nakano, H.Matsuda.
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.205-15 (April 1983).
It has been demonstrated that a family of $\log \dot{\epsilon}$ vs. $\log \sigma$ curves, obtained from stress relaxation tests after monotonic loading, can be superposed on one another by translation (scaling) along a particular direction and that the locus of the translation is linear. The effects of (1) cyclic loading, (2) imposed strain rates, (3) impurities and (4) grain sizes on the shape of $\log \dot{\epsilon}$ vs. $\log \sigma$ curves and the scaling parameter, m have been studied. Stress relaxation curves are concave, and the linear relationship of the locus holds for scaling except for the stress relaxation after fatigue tests and that of single crystals. Measured m values are dependent on impurities and temperature, and independent of other factors. The physical meaning of the scaling locus is discussed referring to the experimental results. The locus of translation is explained by the relation between the preexponential terms $\dot{\epsilon}_0$ and the maximum internal stress $\sigma_1{}^0$. The mechanical equation of state, $f(\dot{\epsilon},\sigma,(\dot{\epsilon}_0,\sigma_1{}^0),T)=0$ is shown to be valid for an arbitrary value of $(\dot{\epsilon}, \sigma, T)$, provided the scaling is possible. (17 refs.)

73129 On Young's modulus of ferritic cast iron. D.Lohe, O.Vohringer, E.Macherauch (Inst. fur Werkstoffkunde I, Univ. Karlsruhe, Karlsruhe, Germany).
Z. Metallkd. (Germany), vol.74, no.5, p.265-73 (May 1983). In German.
The influence of nodular, vermicular and flake graphite shapes on Young's modulus of ferritic cast iron with similar chemical composition has been investigated by a resonance method. With respect to their spacial shapes the graphite particles can basically be classified by spheres, plates and needles and can quantitatively be described by a shape factor η. η extends from $\sim$1.5 in the case of nodular cast iron to $\sim$40 in the case of coarse flake graphite cast iron. Young's moduli of the cast irons investigated with increasing η values decrease up to a factor two. Smaller Young's moduli of cast irons in relation to graphite-free basic alloys are caused by increasing strain contributions of the graphite particles with increasing η values. Measured Young's moduli of cast irons in different graphite shapes are in good agreement with theoretical calculations carried out with two-phase materials especially with regard to the second phases as spheres, plates and needles. (75 refs.)

Elastic-constant anomalies in metallic superlattices: a molecular-dynamics study .... See Entry 72031

Mechanical properties of metal/polymer composites .... See Entry 72032

Phase separation in epoxy resins containing polyethersulphone .... See Entry 72124

Alkali treatment of coir fibres for coir-polyester composites ... See Entry 73062

Influence of V and Zr on the rolling texture, recrystallization, and anisotropy of the Young modulus of Ti-V and Ti-Zr alloys .... See Entry 73105

Strain mechanisms in grey cast iron .... See Entry 73134

Hydrophilic polymeric membranes obtained by radiation cast-copolymerization of ethyl acrylate with various monomers .... See Entry 73137

The effects of extensional creep and creep recovery on the dynamic properties of an unfilled and filled crosslinked polyester resin .... See Entry 73140

Strength and fracture toughness of reaction-bonded Si_3N_4 ...... See Entry 73164

The effect of stress relaxation on the tearing of vulcanized rubber .... See Entry 73173

Fracture toughness/Young's modulus correlation for low-density fibrous silica bodies .... See Entry 73185

High temperature mechanical behaviour of silicon nitrides (Si_3N_4, Sialon) .... See Entry 73207

Sintered boron—production and properties. II. Mechanical and thermophysical properties .... See Entry 73208

81.40L Deformation, plasticity and creep

(see also 62.20F Deformation and plasticity, 62.20H Creep)

73130 Bending strength of silicon nitride at 1250°C under static and cyclic bending load. H.Heigl (Inst. fur Werkstoffkunde, Hochschule der Bundeswehr, Munchen, Germany), K.Heckel.
CFI-Ceram. Forum Int. Ber. Dtsch. Keram. Ges. (Germany), vol.60, no.2-3, p.69-73 (April 1983). In German, English.
The bending strength of reaction bonded silicon nitride at 1250°C is higher than the bending strength at room temperature. A long-time thermal treatment of oxidized specimens has no appreciable influence on the static bending strength at 1250°C. No fatigue failure was observed at one-step fatigue tests up to 20 million cycles of loading. If an oxidized part loaded mainly with bending stresses does not fail at room temperature, it can be expected that it will also stand the load at 1250°C. (4 refs.)

73131 Effect of structural defects on the sorption volume and strength of glass reinforced plastics. V.G.Makarov, S.M.Perlin, A.A.Antonov (Kubyshevskii Polytech. Inst., Kubyshevskii, USSR).
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.3, p.182-6 (1983). In Russian.
The effects of the porosity of glass-reinforced plastics on their strength and absorption properties are reported for high-tensile, glass-fibre filled epoxides. The results for samples with glass fibres from 10-20 micron diameter show water absorption capacities at 45-100% humidity, rupture stress and macro- and micro-defect concentrations as functions of porosity in the range up to 10% porosity. It is shown that strength is enhanced by reducing the porosity and is higher for a uniform pore structure, which reduces the probability of macro-defects. Moisture absorption of short duration leads to a reversible loss of strength, but long-term (over 1000h) absorption to a permanent loss. The absorption effect can be avoided by sealing the surface with a thermoplastic or by creating a diffusion barrier at the surface. (7 refs.) *C.J.S.*

73132 Effect of plasticisation on the durability of orientated polymers. Yu.M.Ivanov.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.3, p.189-93 (1983). In Russian.
Moisture-bonded (wood) cellulose with up to 30% plasticiser (bonded moisture) and polyamide fibres are selected as examples of highly plasticised, fibrous polymers for which literature, experimental data are available for the long-term (typically up to 5 years) mechanical properties. It is shown that the variations in durability caused by molecular plasticisation of orientated polymers can be accounted for using a structurally sensitive coefficient. An expression is obtained for the coefficient for cellulose which involves time, plasticiser concentration, temperature, stress and the rupture activation energy. (18 refs.) *C.J.S.*

73133 Investigation of stresses created by electrically insulating coatings in electrical steel sheet with a ribbed texture. L.M.Sheiko, O.N.Ivanchenko, L.S.Chervonev, F.D.Miroshnichenko (Zaporozhye State Pedagogical Inst., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.201-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1427-30 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
As a result of application of insulating coatings, electrical steel with a ribbed texture may give rise to not only isotropic extension in the plane of the sheet, but also to the more general case of the plane stress state when the principal stresses $\sigma_{ii}$are not equal to one another. The factors causing the ratio of the principal stresses $k_0=\sigma_{22}/\sigma_{11}$ of the tensor σ_{ij} and its individual components σ_{ii} to assume unequal values for different types of coating probably stem from differences in the way in which the coatings are obtained. Among such differences are: conditions of formation of the ceramic layers of the coating; composition of the solutions employed; particular admixtures in the initial materials. (10 refs.)

73134 Strain mechanisms in grey cast iron. L.Haenny, G.Zambelli (Ecole Polytech. Federale, Dept. des Materiaux, Lausanne, Switzerland).
Eng. Fract. Mech. (GB), vol.18, no.2, p.377-87 (1983).
Grey cast iron exhibits a continuous stress-strain curve on which elastic and plastic strains cannot be identified. Tensile straining is analysed in the case of a grey cast iron solidified by continuous casting. It is demonstrated that the main damaging processes are directly related to strain components which can be macroscopically identified. The amount of microcracking is evaluated by the decrease in elastic stiffness. On complete unloading, a small increase in the elastic stiffness is recorded; however, the initial value is not recovered. Deformation due to localized plastic strains is evaluated by recording the tangent modulus. For stresses inducing negligible creep strains the tangent modulus decreases linearly for increased applied stress. Under low stress amplitude, however, an elastic range is clearly observed. (12 refs.)

73135 Analysis of the characteristics of lumped deformation of heterophase crystalline materials. M.N.Pankova, V.A.Solov'ev, S.G.Zaichenko (Inst. of Metallography & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.576-82 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A theoretical study is made of the probability of excitation of secondary shear processes in the field of stresses of primary lumped shear stopped by a layer of a reinforcing phase. The thicknesses of the obstacles necessary to prevent shear are found, i.e. those necessary to suppress macroscopic deformation while retaining the local compliance of a material. Specific calculations are made of the probabilities of the processes occurring in the course of martensitic transformations and resulting in the formation of lightning-shaped groups and branches in martensite grains in real steels. (9 refs.) *A.T.*

73136 Relationship between the coefficients of normal anisotropy in the plastic behaviour of sheet metals. J.D.Bressan, J.A.Williams (Dept. of Engng., Univ. of Cambridge, Cambridge, England).
Int. J. Eng. Sci. (GB), vol.21, no.7, p.847-9 (1983).
Hill (see Math. Proc. Camb. Phil. Soc., vol.85, p.179, 1979) has proposed a refinement of his classical yield function to account for the discrepancies observed between the material stress-strain curve obtained from biaxial stretching experiments and that predicted on the basis of data from uniaxial tension tests. These discrepancies are greatest when the coefficient of normal anistropy, R, is less than unity. For plane stress conditions, with principal in-plane stresses σ_1 and σ_2 the new yield function can be written as $2(1+R)Y^m=(1+R)|\sigma_1-\sigma_2|^m+|\sigma_1+\sigma_2|^m$ where Y is the uniaxial yield stress in tension. m is a new material parameter introduced to give the yield function a more general character and to accommodate specifically the anisotropic plastic behaviour of materials for which $R<1$ and for which therefore normal anisotropy is described by two parameters R and m. (6 refs.)

73137 Hydrophilic polymeric membranes obtained by radiation cast-copolymerization of ethyl acrylate with various monomers. M.Kumakura, I.Kaetsu (Takasaki Radiation Chem. Res. Establ., JAERI, Takasaki, Gunma, Japan).
J. Mater. Sci. (GB), vol.18, no.5, p.1335-40 (May 1983).
Hydrophilic polymeric membranes were prepared by radiation cast-copolymerization of ethyl acrylate with various diacrylates and dimethacrylates. The hydration and mechanical properties of the copolymers were studied as a function of copolymerization composition. The degree of hydration, tensile strength, tear strength, elongation at break, and Young's modulus increased with decreasing concentration of the ethyl acrylate component. In a certain copolymerization composition, the hydrophilic polymeric membranes which resemble the mechanical property of the biomedical materials were obtained. (8 refs.)

73138 Bending properties of creased zones of paperboard related to interlaminar defects. L.Carlsson, A.De Ruvo, C.Fellers (Dept. of Paper Technol., Swedish Forest Products Res. Lab., Stockholm, Sweden).
J. Mater. Sci. (GB), vol.18, no.5, p.1365-73 (May 1983).
A parallel beam model is presented for the bending behaviour of locally delaminated zones (creases zones) of paperboard. It is shown that the bending moment and the force levels are strongly dependent on the geometry and elastic properties of the creased zone. A favourable condition for low crease stiffness is a large number of long interlaminar failures. Experimental measurements of the crease stiffness and maximum bending moment for paperboards with implanted defects of various lengths and numbers were in reasonably good agreement with the crease stiffness predicted by the parallel beam model. (7 refs.)

73139 Effect of vacuum-treatment on mechanical properties of W-Ni-Fe heavy alloy. H.K.Yoon, S.H.Lee, S.-J.L.Kang, D.N.Yoon (Dept. of Materials Sci. & Engng., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
J. Mater. Sci. (GB), vol.18, no.5, p.1374-80 (May 1983).
The effect of heat treatment in vacuum and hydrogen on the ductility and UTS of the sintered 96W-2.8Ni-1.2Fe (by wt%) heavy alloy has been studied. The elongation of the as-sintered alloy is about 8%, but after a few minutes of heat treatment in vacuum at 800°C it increases markedly to about 19%. When the sintered specimen is heat-treated in vacuum at 600°C, the elongation increases rapidly with time, reaching 20% after about 10 min. The values of UTS also increase after vacuum treatment. Heat treatment in hydrogen, however, shows no change in mechanical properties from the as-sintered state. The effect of vacuum treatment is thus attributed to the removal of hydrogen embrittlement. Based on the hydrogen diffusion model, a practical guideline is suggested for determining the optimum vacuum treatment conditions. The scanning electron micrographs of the fracture surfaces show that hydrogen weakens mainly the interface between tungsten grains and matrix. (14 refs.)

73140 The effects of extensional creep and creep recovery on the dynamic properties of an unfilled and filled crosslinked polyester resin. D.Katz, Y.Smooha (Dept. of Materials Engng., Technion Israel Inst. of Technol., Haifa, Israel).
J. Mater. Sci. (GB), vol.18, no.5, p.1482-90 (May 1983).
Changes in the dynamic properties of unfilled and filled cured polyester resins during extensional creep were measured with the aid of a modified torsion pendulum. Glass beads were used as filler. The decrease in the real shear modulus during creep is attributed mainly to a debonding process. Dewetting-rewetting processes reflected by modulus changes, were discussed on the basis of a theory of Takahashi et al. (1978). Voigt-Kelvin rheological models were used to characterize the modulus and the creep compliance recoveries after load release. (7 refs.)

73141 Straw-reinforced polyester composites. N.M.White, M.P.Ansell (School of Materials Sci., Univ. of Bath, Bath, England).
J. Mater. Sci. (GB), vol.18, no.5, p.1549-56 (May 1983).
Annual crop fibres are rich in cellulose and they are a cheap and rapidly renewable source of fibres with potential for polymer reinforcement. Straw fibres have been incorporated in a polyester resin matrix and the properties of the fibre and composite determined. The fibres have a Young's modulus of approximately 8 GN m^{-2} and an effective density of 5.1 kN m^{-3} when combined with resin. Useful composites can be formulated with an optimum fibre volume fraction of about 0.61, resulting in a flexural stiffness of 7.3 GN m^{-2} and flexural strength of 56 MN m^{-2}. The specific flexural stiffness is about 2.5 times greater than that of polyester resin and about half that of softwoods and GRP. The work of fracture measured in impact is about half that of softwoods. It is envisaged that alternative methods for processing the fibres and the use of a phenolic resin matrix will improve the composite properties further. Straw-based composites are suitable as core material for structural board products. (10 refs.)

73142 Compaction effect on flexural behaviors of fiber reinforced concretes. K.Okada (Faculty of Engng., Kyoto Univ., Kyoto, Japan), T.Mise, M.Mashima, T.Ideguchi.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.353, p.168-74 (Feb. 1983). In Japanese.
Fiber reinforced concrete contains a large amount of short fibers randomly dispersed into cement concrete and this composite material is superior to normal plain concrete with respect to its flexural strength, impact resistance and ductility. But the consistency of concrete is extremely decreased by adding fibers so that in some cases it becomes difficult to place and mold by the ordinary method. The effects of compaction methods on the strength of fiber reinforced concretes having poor consistency and containing a fairly large amount of fibers were investigated. Conventional steel fibers and

alkali-resistant glass fibers were used. Test specimens (10×10×60 cm) of plain and fiber reinforced concretes were compacted by external vibration with temporary or continuous compressive loading, and were tested in flexure. The test results indicate that the compaction with compressive loading increases the flexural strength of both types of fiber reinforced concretes as well as the extensibility of glass fiber reinforced concrete although the improvement is made within a certain limit of compaction loading. (6 refs.)

73143 Characteristics of microstructure during tensile deformation of superplastic Al-Zn eutectoid alloy. Y.Motohashi, T.Shibata (Dept. of Mech. Engng., Ibaraki Univ., Hitachi, Ibaraki, Japan).
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.49-59 (1982).
Microstructures during plastic deformations were studied by scanning electron microscopy and the plastic-carbon replication technique. Grain boundary sliding (GBS) is a predominant deformation mode in the initial stage of strain ($\varepsilon \lesssim 50\%$). The GBS decreases as the strain increases and the elongation of Zn rich phase along the tensile axis predominates after large strains ($\varepsilon \gtrsim 100\%$). Grain-growth of the Zn rich phase is also observed, while that of Al rich phase is only little. The Al rich phase becomes a spheroidal shape and is surrounded by the Zn rich phases. Therefore, initial equiaxial structure of the alloy has broken after large strains, but the superplastic deformation continues. No evidence of crystallographic slip (CS) in the grains is observed. Both GBS and CS occur in a region in which the alloy deforms at low temperatures (230 to 253K) and high stresses. Large ductility of the Zn rich phase caused by preferential diffusion of Zn is a significant mode of superplastic deformation for this alloy. (10 refs.)

73144 Role of grain boundary segregation in diffusional creep. E.D.Hondros, P.J.Henderson (Div. of Materials Applications, Teddington, England).
Metall. Trans. A (USA), vol.14A, no.4, p.521-30 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
The high temperature deformation of polycrystalline materials by the stress directed flow of vacancies is now a well established creep mechanism which operates in two temperature regimes: high temperature, or Nabarro-Herring creep, in which lattice diffusion is rate determining, and low temperature, or Coble creep, in which grain boundary diffusion predominates. Multicomponent engineering alloys will normally experience, as part of their processing history or service lives, the segregation enrichment of interfaces such as grain boundaries by species present in solid solution. The authors evaluate the experimental information and to explore the manner in which this segregation affects the principal forms of diffusional creep. Cases of retarded Herring-Nabarro creep are analyzed in terms of the efficacy of grain boundaries as sources and sinks for vacancies: strongly bound segregant atoms at grain boundaries affect the mobility of defects and hence control the operation of vacancy sources. They assess the magnitude of the effect induced by various surface active species on grain boundary diffusivity and consequently on Coble creep; predictions show that in general, small amounts of highly surface active impurities induce a remarkable inhibition of this form of creep. (31 refs.)

73145 Crack and cavity nucleation at interfaces during creep. M.H.Yoo (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), H.Trinkaus.
Metall. Trans. A (USA), vol.14A, no.4, p.547-61 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
Athermal nucleation of microcracks and thermal nucleation of cavities during creep deformation are reviewed with an emphasis on effects of solute segregation to grain boundaries and cavity surfaces. The magnitude and the duration of stress concentration at a triple grain junction or at a grain boundary inclusion are estimated for transient Coble creep and steady state power-law creep conditions. Stable configurations of wedge-type microcracks are predicted by a Griffith-like crack model. The rate for thermal nucleation of cavities is obtained by the Fokker-Planck equation for vacancy clusters. Cracks and cavities are interdependent, and cavity nucleation occurs continuously throughout the three creep stages. The local stress concentration enhances microcrack and cavity nucleation. The cavity nucleation rate is generally increased as a result of solute segregation to the surfaces and interfaces and/or gas precipitation into cavity volume. This enhanced nucleation is more effective in a system with mobile solutes than with immobile solutes. Immobile solute or trace elements may affect the nucleation rate also by changing the grain boundary diffusivity. Experimental techniques for quantitative analyses of cavity nucleation processes are discussed. (83 refs.)

73146 The effects of segregation on the kinetics of intergranular cavity growth under creep conditions. W.D.Nix, K.S.Yu, J.S.Wang (Dept. of Materials Sci. & Engng., Stanford Univ., Stanford, CA, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.563-70 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
Intergranular cavity growth under creep conditions is examined with particular reference to the potential effects of segregation on cavity growth. When cavities are present on all of the boundaries in a polycrystalline solid, they are able to grow in an unconstrained manner. Under these conditions the rate of cavity growth may be controlled by grain boundary diffusion (D_{GB}), surface diffusion (D_s), or power law creep, which in turn is controlled by lattice diffusion (D_L). When only isolated boundaries are cavitated, cavity growth is constrained and may be completely limited by creep flow of the surrounding grains. The segregation of solute to the grain boundary and the cavity surface can influence the kinetics of cavity growth in several different ways. The reduction in surface energy associated with segregation can increase the rate of cavity growth when the cavities are crack-like. The effects of segregation on grain boundary and surface diffusion can also influence the rate of cavity growth. A phenomenological relation proposed by Borisov et al. indicates that D_{GB}/D_L decreases with segregation, thus causing grain boundary diffusion controlled cavity growth to be slowed by segregation. In some cases solute additions increase D_L, thus increasing the rate of creep controlled cavity growth. (30 refs.)

73147 The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures. S.-H.Chen (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, PA, USA), T.Takasugi, D.P.Pope.
Metall. Trans. A (USA), vol.14A, no.4, p.571-80 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
The development of current ideas about impurity effects on the ductility of steels at elevated (creep) temperatures is reviewed and the effects of low temperature intergranular failure (LTIF) studies on these ideas are emphasized, e.g., temper embrittlement studies. The possible mechanisms by which impurities can induce high temperature intergranular failure (HTIF) are then reviewed. It is shown that impurity effects on LTIF and HTIF can be quite different and therefore there need be no correlation between the two phenomenon. Experiments on a bainitic 1 Cr-1.25 Mo-0.25 V steel containing deliberately added Mn, P, Si, and Sn show that these additions can either decrease or have no effect on the extent of HTIF compared with undoped material, depending upon the austenitizing temperature. These results may be due to a possible reduction of segregated grain boundary S due to competition between S and P for available grain boundary sites. (The steels used contain approximately 40 wt p.p.m. residual S.) These results resolve some of the controversies in the literature on the effects of grain boundary impurities on HTIF. (51 refs.)

73148 Residual and trace element effects on the high-temperature creep strength of austenitic stainless steels. R.W.Swindeman, V.K.Sikka, R.L.Klueh (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.581-93 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
The heat-to-heat variation in the creep strength and ductility of austenitic stainless steels was reviewed from the viewpoint of residual and trace element effects. Based on data reported in the literature, the creep strength of unstabilized alloys such as types 304 and 316 stainless steel increased with residual element and trace element content. Niobium appeared to be the most potent strengthener. There was no direct evidence that trace elements such as sulfur and phosphorus had a deleterious effect on either strength and ductility. It was assumed that the creep strength and ductility of the unstabilized grades of austenitic stainless steels are controlled by the precipitate characteristics. It follows from this that thermomechanical treatment or residual element additions that affect the precipitate characteristics influence subsequent time dependent mechanical properties. This view is consistent with most of the information in the literature. (53 refs.)

73149 The effect of cerium on high temperature tensile and creep behavior of a superalloy. F.Cosandey (Henry Krumb School of Mines, Columbia Univ., New York, NY, USA), F.Sczerzenie, D.Li, J.K.Tien.
Metall. Trans. A (USA), vol.14A, no.4, p.611-21 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
The presence of trace impurities such as S and O can cause embrittlement during elevated and high temperature deformation of iron or nickel-base alloys. Various amounts of Ce, ranging from 0 to 0.24 wt. pct, have been added to an iron-nickel base superalloy, Udimet 901, in order to study its role in the refining process of S and O in the melt, hot workability, creep and stress rupture, and microstructure. It is found that Ce addition decreases the O and S content in the melt and improves both the hot workability and creep ductility. An optimum residual Ce content of 30 p.p.m. was found for which ductilities are maximum. Higher residual cerium contents result in deleterious hot embrittlement. SEM as well as TEM/STEM microscopy combined with X-ray EDS spectroscopy were used to determine the inclusion content present in the alloy as the fine spatial microchemistries, especially at grain boundaries. (38 refs.)

73150 Plastic constraint and ductility in tensile notched specimens of amorphous $Pd_{78}Cu_6Si_{16}$. H.Kimura, T.Masumoto (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Metall. Trans. A (USA), vol.14A, no.4, p.709-16 (April 1983).
The plastic constraint factor and tensile deformation mechanics of notch-free and notched specimens of amorphous $Pd_{78}Cu_6Si_{16}$ are studied for a variety of geometries over a temperature range of 77 to 473K. A transition with plate thickness between an antiplane-strain mode and a general yielding mode appears for notch-free and single-edge-notched bulky specimens, showing a set of two intersecting shearing plnes inclined at 51 deg to 54 deg to the tensile axis. For circumferentially-notched round specimens, constrained general yielding occurs beyond a critical notch depth. The plastic constraint factor (L_{exp}) increases with decreasing notch angle; this factor relates to the theoretical factor of slip-line field (L_{cal}) by $L_{exp}=\beta L_{cal}$, where β is constant. The plastic constraint factor attains, at the maximum, 2.4 for deep 0 deg notch; this is nearly equal to the upper limit of Hill's slip-line-field solution, indicating that an amorphous $Pd_{78}Cu_6Si_{16}$ alloy is a 'perfect' ductile material. (26 refs.)

73151 The effect of shear bands on service properties of Ti-6Al-2Sn-4Zr-2Mo-0.1Si forgings. S.L.Semiatin, G.D.Lahoti (Battelle's Columbus Labs., Columbus, OH, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.743-50 (April 1983).
The effect of shear bands on the elevated temperature tensile, creep, and fatigue properties of Ti-6Al-2Sn-4Zr-2Mo-0.1Si (Ti-6242) forgings has been established. Evaluations on forgings containing and not containing shear bands demonstrated that the effect is very small if not negligible in tensile and fatigue loading. For these types of loading, observations were explainable on the basis of the fact that the shear bands are regions of somewhat higher hardness than the remainder of the forging, and, thus, failure tended to nucleate away from the shear bands. In contrast, shear bands had a noticeable effect on stress-rupture properties. The deleterious effects under this type of loading were ascribed to microscopic processes such as enhanced diffusion along shear bands. (23 refs.)

73152 Deformation behavior of blended elemental Ti-6Al-4V compacts. G.Welsch, Y.-T.Lee (Case Inst. of Technol., Case Western Reserve Univ., Cleveland, OH, USA), P.C.Eloff, D.Eylon, F.H.Froes.
Metall. Trans. A (USA), vol.14A, no.4, p.761-9 (April 1983).
A blended elemental Ti-6Al-4V alloy powder, sintered to 99 pct theoretical density, was tested in tension and fatigue and characterized by optical, scanning, and transmission electron microscopy and by X-ray energy dispersive analysis. The microstructure consisted of a combination of equiaxed and low aspect ratio lamellar alpha phase. Two types of pores were observed: macrophores at grain boundaries or triple points, and micropores within alpha regions. Chemical homogeneity was achieved within individual alpha or beta regions with slight compositional fluctuations between different grains. The deformation modes in alpha regions were investigated by transmission electron microscopy on thin foils prepared from tensile and cyclically deformed specimens. Tensile deformation occurred by homogeneous slip on both prismatic and pyramidal alpha slip planes. In cyclic deformation, on the other hand, little slip activity was found except for some heterogeneous slip on the basal plane associated with a relatively large micropore. Micropores of ≤0.5 μm size were found to act as dislocation pinning sites. (26 refs.)

73153 Evaluation of the long-term deformation behaviour of plastic materials. H.Honinger, E.Reichelt.
Plaste & Kautsch. (Germany), vol.30, no.3, p.166-72 (March 1983). In German.
Characteristic values and functions of static long-term deformations are at present assumed in the solution of problems associated with plastic applications. As a result of extensive experimental research, the deformation characteristics of plastics available in the DOR have now been documented. Performance and analysis of creep experiments are also given for PVC, PMMA, ABS, PE, PP, PA, PTFE, EVAC, GUP, PF-SPS, and a number of other polymers. (17 refs.) *A.E.W.*

73154 The tensile strengths of single powders and binary mixtures. S.Y.Chan, N.Pilpel (Dept. of Pharmacy, Univ. of London, London, England), D.C.-H.Cheng.
Powder Technol. (Switzerland), vol.34, no.2, p.173-89 (March-April 1983).
A theory of tensile strength for single powders and binary mixtures has been developed by means of equations incorporating the particle size parameters and the compositions of binary mixtures. New concepts of using 'reduced tensile strength' and choosing a reference state are introduced. These, together with the law of corresponding states, enable the tensile strengths of powders and binary mixtures to be calculated with an accuracy of about ±15%. (21 refs.)

73155 Effect of the type of binding material on the properties of refractory glass-fiber heat-insulation products. V.V.Martynenko, A.N.Gaodu, Z.D.Zhukova, E.I.Zoz, E.V.Degtyareva (Komsomol Kharkov Automobile & Highway Inst., Ukrainian SSR).
Refractories (USA), vol.23, no.9-10, p.491-7 (Sept.-Oct. 1982). Translation of: *Ogneupory (USSR)*, vol.23, no.9, p.39-44 (Sept. 1982). [received: May 1983]
The effect of binders (water glass, silica sol, chromium-aluminophosphate binder, bentonite, and polyvinyl-acetate dispersion) on the basic properties of thermal-insulation glass-fiber refractory articles have been studied. It is shown that the use of polyvinyl acetate as the binder in minimum quantities and density gives the maximum bend strength of glass-fiber thermal-insulation articles, with fairly low shrinkage and thermal conductivity. However, the strength of these articles on heating is minimal. It is established that the use of silica sol as the binder gives minimum shrinkage on heating with fairly low density and thermal conductivity but high strength on heating. However, the distribution of binder in the production of articles is very nonuniform. The best characteristics in the articles are provided by a combined binder consisting of a mixture of silica sol and the polyvinyl-acetate dispersion. (11 refs.)

73156 Mechanical properties of glass-crystal structures based on corundum. I.I.Vishnevskii, N.D.Tal'yanskaya (Sci.-Res. Inst. of Refractories, Ukrainian SSR).
Refractories (USA), vol.23, no.9-10, p.508-14 (Sept.-Oct. 1982). Translation of: *Ogneupory (USSR)*, vol.23, no.9, p.53-8 (Sept. 1982). [received: May 1983]
The dependence of the deformation rate at the established state of creep of glass-crystal corundums on the stress and temperature indicate the essential deviation in the deformation process from the quasiviscous-flow regime. The creep of such structures is determined by the degree of bonding of the crystal phase, the size of the crystals, and the amount and distribution of the glass phase. When the concentration of the glass phase is 3-10%, the specimens of glass-crystal corundum are deformed 10^3-10^4 times more rapidly than the pure crystalline material with similar grain size of corundum. It has been established that the decrease in the deformation after the glass crystal corundums have been annealed (mechanical aftereffect) reaches ~50% of the initial values obtained after creep. (12 refs.)

73157 Structure and properties of permeable fine-fiber materials produced from powders. I.M.Fedorchenko, A.G.Kostornov, O.V.Kirichenko, N.S.Guzhva (Inst. of Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.718-21 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.42-5 (Sept. 1982). [received: March 1983]
Nickel and Ni-Cr, Ni-Mo, Ni-Cr-Mo, Ni-Fe-Cr, and Ni-Fe alloy FFMs of 10- to 28-μm fiber diameters were obtained, and a study was made of the effect of the key structural characteristics of FFMs on their hydraulic and mechanical properties. (4 refs.)

73158 Change in transverse strain coefficient in a plane stress state. A.A.Ostrovskii (Kiev Engng. Inst. of Food Industry, Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.593-7 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.24-7 (May 1982). [received: May 1983]
The author shows how accounting for the change in the transverse strain coefficient makes it possible to construct stress/strain curves from measurements of just one of the principal strains if the principal stress ratio is known. It also permits experimental determination of the plane stress state created in the working part of broad flat specimens in uniaxial tension. (13 refs.)

73159 Link between stress and strain of initially anisotropic materials with anisotropic strain hardening. V.N.Bastun (Inst. of Mech., Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.615-20 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.42-6 (May 1982). [received: May 1983]
The author considers the method of plotting strain diagrams for initially anisotropic materials with isotropic strain hardening caused by loading following linear trajectories, a method free from limitation applied to the relevant type of resistance to tension and compression. (9 refs.)

73160 Dependence of the strength of materials on temperature and strain rate. V.A.Borisenko, B.D.Kosov, V.P.Krashchenko (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.624-8 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.50-4 (May 1982). [received: May 1983]
The authors present the formulation of a generalising equation correlating the strength of a material, the strain rate, and the thermodynamic parameters (temperature and the spectrum of activation energy of the process of plastic deformation). (12 refs.)

73161 Plastic deformation of a metastable stainless steel at low temperatures. I.A.Shapovalov, V.Ya.Il'ichev (Physicotech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.629-35 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.54-9 (May 1982). [received: May 1983]
In plastic deformation at low temperatures of chrome-nickel steel in the as-received condition and also of that heat treated and previously deformed at room temperature, nonuniformity of plastic deformation is observed. The latter is revealed in a break in load on the stress-strain curve and in the formation of a local plastic zone in the sample. The loss of strength of the steel is caused by the occurrence of the martensite transformation. The source of spontaneous origin of martensite may be the cellular dislocation structure in the austenite matrix. (18 refs.)

73162 Deformation of polymeric compounds based on synthetic rubber SKTN in the operating temperature range 203-343K. I.A.Kozlov, N.G.Nikolenko, V.P.Privalko, A.B.Yudin (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.641-3 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.64-6 (May 1982). [received: May 1983]
In order to predict the operational reliability for radioelectronic equipment based on polymeric compounds (PMC) the authors study the temperature dependence of strains occurring in the PMC during operation of the article. Compounds KLT-30 and PK-68 based on low-molecular rubber SKNT used extensively in radioelectronic equipment were selected for study. The study was carried out by means of tensoresistors. (no refs.)

73163 Subsurface plastic deformation in machining 6Al-2Sn-4Zr-2Mo titanium alloy. S.Jeelani (Dept. of Mech. Engng., Tuskegee Inst., Tuskegee, AL, USA), K.Ramakrishnan.
Wear (Switzerland), vol.85, no.1, p.121-30 (15 Feb. 1983).
The effect of cutting speed and tool geometry on the plastic deformation in the surface region of 6242 titanium alloy machined orthogonally under lubricated and unlubricated conditions is determined using the grid technique and metallography. The results show that the magnitude of the plastic deformation in the surface region and the depth of the work-hardened layer increase with an increase in the cutting speed or the tool wear land length. The presence of the lubricant in the cutting region results in a considerable reduction in the subsurface damage. (21 refs.)

Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure' ....See Entry 69779

Application of the ASME-code-case N 47 to a typical thick-walled HTR-component made of Incoloy 800 ....See Entry 70645

Materials available and the present state of research into the basis for the design of high temperature components for HTR-plants ....See Entry 70688

The influence of the flow and material characteristics on failure analysis ....See Entry 70694

Letter concerning the paper 'On the double-sliding free-rotating model for the deformation of granular materials' ....See Entry 71402

Creep and rupture strength with a nonuniform stress state ....See Entry 71405

Role of geometry in plastic instability and fracture of tubes and sheet ....See Entry 71467

Structural changes in nickel after ultrasonic action with subthreshold amplitudes in liquid helium ....See Entry 71967

Theoretical latent hardening of crystals in double-slip. II. FCC crystals slipping on distinct planes ....See Entry 71968

Structure and properties of chromomanganese austenitic steels hardened by hydraulic extrusion ....See Entry 71971

Investigation of changes in the grain-boundary structure as a result of recrystallization of a magnesium alloy after weak deformation ....See Entry 71972

Crystallogeometric features of the subgrain structure and their relationship to the deformation texture ....See Entry 71973

Mechanical properties of metal/polymer composites ....See Entry 72032

A micromechanical theory of grain-size dependence in metal plasticity ....See Entry 72034

On the scaling behaviour in a log σ-log $\dot{\varepsilon}$ diagram ....See Entry 72035

Theory of steady-state creep with a complex stress state ....See Entry 72036

The temperature dependence of coefficient of viscosity for $Cu_{60}Zr_{40}$ and $Ni_{64}Zr_{36}$ metallic glasses ....See Entry 72148

Macromechanism of powder deformation in the incoherent zone during rolling ....See Entry 73018

Effect of composition of powder mixtures and rolling temperature on the compactibility and properties of strip ....See Entry 73027

Reductive additives in powder metallurgically prepared Cu-Nb_3Sn composite wires ....See Entry 73030

Hot pressing and properties of different Si_3N_4 qualities ....See Entry 73051

Alkali treatment of coir fibres for coir-polyester composites ....See Entry 73062

Strengthening of polyphase Si_3N_4 materials through oxidation ....See Entry 73100

Numerical determination of the parameters of Krupkowski's function for a torsion test taking into consideration the strain hardening ranges ....See Entry 73108

The sintering of creep-induced cavities in a low-alloy ferritic steel (1Cr1Mo0.75V) ....See Entry 73112

Behaviour of titanium alloy Ti-6% Al-4% V in the range of hot heating. ....See Entry 73113

Control of microstructures of ($\alpha+\beta$)-titanium alloys ....See Entry 73115

Cyclic stress relaxation of polycrystalline metals at elevated temperature ....See Entry 73122

Internal friction due to hysteretic dislocation motion in solid solution crystals ....See Entry 73123

The shape of stress relaxation curves and the mechanical equation of state in molybdenum ....See Entry 73128

Fracture strains in biaxially loaded 2024 aluminum tubes ....See Entry 73169

Plastic deformation in the course of fracture of ferrite-pearlitic steels ....See Entry 73175

The effect of non-uniform bending deformation on the stability of circumferential growth of through-wall cracks in brass tubes ....See Entry 73178

The influence of morphology and molecular weight on ductile-brittle transitions in linear polyethylene ....See Entry 73181

Impact strength of En8 steel diffusion bonds ....See Entry 73182

Grain boundary sliding and stress concentration during creep ....See Entry 73197

High temperature embrittlement of Ni and Ni-Cr alloys by trace elements ....See Entry 73198

The enhancement of hydrogen attack in steel by prior deformation ....See Entry 73200

Microstructures and mechanical properties of hot isostatically pressed powder metallurgy alloy APK-1 ....See Entry 73204

Sintered boron—production and properties. II. Mechanical and thermophysical properties ....See Entry 73208

Laws of plastic strain and fatigue fracture of metals in torsion ....See Entry 73209

Allowing for strength anisotropy in estimating the rupture strength of actual tubes in a plane stress state ....See Entry 73210

Influence of the type of solidification of a cast nickel alloy of the ZhS6 family on its high temperature strength ....See Entry 73211

The interaction of dislocation with Θ'-precipitates in a Al-2.8% Cu-alloy during fatigue tests ....See Entry 73215

Damage during friction and dislocation structure of gold-platinum solid solutions ....See Entry 73219

Ductility and the abrasive wear of an ultrahigh strength steel ....See Entry 73231

Effect of pH on the stress corrosion cracking of α-brass in chlorate solution ....See Entry 73253

Micro-hardness of non-irradiated uranium dioxide ....See Entry 73292

Statistical modeling of the creep characteristics of structural materials ....See Entry 73305

81.40N Fatigue, embrittlement, and fracture

(inc. hardness; see also 62.20M Fatigue, brittleness, fracture and cracks)

73164 Strength and fracture toughness of reaction-bonded Si_3N_4. S.C.Danforth, M.R.Richman (Brown Univ., Providence, RI, USA).
Am. Ceram. Soc. Bull. (USA), vol.62, no.4, p.501-4, 516 (April 1983).
Reaction-bonded Si_3N_4 was produced with various microstructures to investigate the effect of α/β ratio on modulus of rupture and fracture toughness. Room-temperature MOR was found to be independent of the α/β ratio of the materials tested, a result of machining-induced flaws rather than inherent microstructural flaws acting as the fracture origins in most cases. Notched-beam fracture toughness was also independent of α/β ratio. The average value was $K_{IC}=2.316\pm0.180$ NM.m$^{-3/2}$, which agrees quite well with the value determined fractographically. (36 refs.)

73165 The load concentration factor and the statistic theory of crack propagation of a unidirectionally fiber-reinforced composite. Fan Fu-qun (South China Polytech. Inst., China).
Acta Mech. Solida Sin. (China), no.3, p.287-95 (1981). In Chinese.
Discusses two principal viewpoints concerning the statistic theory of crack propagation. One is the calculation of stress redistribution due to sequential fiber breaking. By using the model common in shear-lag investigations, both plastic analysis by the deformation theory and elastic analysis are made. The results of the elastic analysis agree with those obtained by J.M. Hedgepeth (1961). Also, studies are made on the development of a crack propagation model. The Gucer-Gurland-Rosen Chain Model is abandoned while a model of a gradually enlarging crack layer is presented. Through a statistic analysis by the method used by A.S. Argon et al. (1974), a formula for calculating the tensile strength of a unidirectionally fiber-reinforced composite is obtained. (12 refs.)

73166 SEM observations of the initiation and propagation of cracks in a short fibre-reinforced thermoplastic composite under stress. N.Sato, T.Kurauchi, S.Sato, O.Kamigaito (Toyota Central Res. & Dev. Labs. Inc., Nagakute-cho, Aichi-gun, Aichi, Japan).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.188-90 (May 1983).
SEM observations were made to study in detail the process of crack initiation and crack propagation in a short fibre-reinforced composite under load. Fractographs indicating the initiation and propagation of the crack were obtained. The short fibre-reinforced composite was made from polyamide 6.6 and 15 vol.% glass fibre. (4 refs.)

73167 Effect of oxidizing environment on the strength of H451, PGX and IG-11 graphites. M.Eto, F.B.Growcock (Dept. of Nuclear Energy, Brookhaven Nat. Lab., Upton, NY, USA).
Carbon (GB), vol.21, no.2, p.135-47 (1983).
The effect of gaseous environment on the compressive and tensile strengths of H451, PGX and IG-11 graphites has been examined. Oxidation was carried out in O_2-, CO_2- and H_2O-containing environments. The stretch losses incurred by H451 and IG-11 graphite did not appear to be affected by the nature of the oxidizing gas. However, the strength loss incurred by PGX graphite appeared to be greater in O_2 than in CO_2 or H_2O. A mechanism consistent with the observed behavior of PGX graphite is proposed: the iron impurity, which is locally distributed in the binder, may be catalytically active during oxidation in CO_2 or H_2O, leading to formation of a few large pits, whereas oxidation in O_2 may lead to the more detrimental condition of a high density of small pits. No effect of reaction temperature on the strengths of the graphics was observed. Attempts to fit strength-burnoff data to a standard expression were only partially successful. Much improved fits were obtained when this expression was modified to account for the development of the micro/mesopore network during oxidation. (30 refs.)

73168 The use of acoustic emission techniques to monitor fracture processes in high strength precipitation hardened aluminum alloys. A.Arieli, R.P.Wells, M.A.Hamstad, A.K.Mukherjee (Dept. of Mech. Engng., Univ. of California, Davis, CA, USA).
Mech. Mater. (Netherlands), vol.2, no.1, p.1-7 (April 1983).
The ductile fracture of dispersion hardened aluminum alloy containing brittle intermetallic inclusions is briefly reviewed. The effect of the size, distribution and chemical composition of the inclusions in affecting the matrix fracture behavior is discussed. The potential of acoustic emission techniques in being able to discriminate between different microstructures produced by various thermomechanical treatment is emphasized. It is shown that processes that affect dislocation motion, i.e. cold work, precipitation, solute atom diffusion, etc., also affect the acoustic response, thus making the AE technique extremely useful for the study of flow and fracture behavior of aluminum alloys. (11 refs.)

73169 Fracture strains in biaxially loaded 2024 aluminum tubes. M.G.Stout, S.S.Hecker (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Mech. Mater. (Netherlands), vol.2, no.1, p.19-22 (April 1983).
2024 aluminum tubes, heat treated to a T6 and T8 temper, were proportionally loaded to failure with combinations of tension and internal pressure. The authors measured diffuse instability and fracture strains and compared these to the ductile fracture model of Ghosh (1976). Agreement was quite good. Fracture strains measured in axial tension and pure hoop tension were equivalent even though anisotropies were observed in the plastic deformation of the tubes. (7 refs.)

73170 Statistical modeling of fatigue-crack growth in a nickel-base superalloy. J.N.Yang (School of Engng. & Appl. Sci., George Washington Univ., Washington, DC, USA), G.C.Salivar, C.G.Annis,Jr..
Eng. Fract. Mech. (GB), vol.18, no.2, p.257-70 (1983).
Two fracture mechanics-based statistical models for the fatigue crack propagation of engine materials are developed. The models are applied to fatigue crack growth rate data for IN100, a nickel-based superalloy used in F100 engine disks, at various elevated temperatures, loading frequencies and stress ratios. The lognormal and the randomized parameter models allows the incorporation of the statistical variability associated with crack growth data into the life prediction process. The statistical distributions of (i) the crack growth rate, (ii) the propagation life to reach a given crack size, and (iii) the crack size at any given service life have been derived. A correlation analysis is performed to compare the results of the statistical models with test data. The correlation is demonstrated to be very good. (4 refs.)

73171 Estimating the statistical properties of crack growth for small cracks. P.W.Hovey, J.P.Gallagher, A.P.Berens (Univ. of Dayton Res. Inst., Dayton, OH, USA).
Eng. Fract. Mech. (GB), vol.18, no.2, p.285-94 (1983).
A series of statistical studies were conducted on two sets of fatigue crack growth data which were generated under variable amplitude loading from cracks that initiated in 7475-T7351 aluminum down in the bore of typical aircraft quality prepared holes. The study considered fatigue crack growth (life) behavior and fatigue crack rate behavior. Generally, the study showed that small crack growth behavior was similar to that observed for larger cracks and that a stress intensity factor parameter could be used to describe the mean trend of the fatigue crack growth rate behavior via a power law relationship. (10 refs.)

73172 Crack closure studies under constant amplitude loading. S.Chand, S.B.L.Garg (Mech. Engng. Dept., Motilal Nehru Regional Engng. Coll., Allahabad, India).
Eng. Fract. Mech. (GB), vol.18, no.2, p.333-47 (1983).
Crack closure experiments were performed on 6063-T6 Al-alloy using a COD-gauge for various load ranges and stress ratios. Experimental results show that for a given stress ratio, R, the crack closure load goes on decreasing as crack length increases (or K_{max} increases) and reaches even below minimum load level at higher values of stress ratios. On the basis of these experimental results, a model for effective stress intensity range ratio U, which is found to be a function of stress ratio R and K_{max}, is developed. (21 refs.)

73173 The effect of stress relaxation on the tearing of vulcanized rubber. R.S.Rivlin (Lehigh Univ., Bethlehem, PA, USA), A.G.Thomas.
Eng. Fract. Mech. (GB), vol.18, no.2, p.389-401 (1983).
A two-network model for an elastomer in which stress relaxation has taken place, similar to that proposed by Green and Tobolsky (1946) is used to calculate the incipient characteristic energy for tearing and to study its dependence on the number of chain segments in each of the two networks, the number of links in these chain segments, the extension at which the stress relaxation took place and the orientation of the tear. (13 refs.)

73174 Near-threshold fatigue crack propagation of several high strength steels. T.L.Mackay, B.J.Alperin, D.D.Bhatt (Douglas Aircraft Co., McDonnell Douglas Corp., Long Beach, CA, USA).
Eng. Fract. Mech. (GB), vol.18, no.2, p.403-16 (1983).
In support of Douglas Aircraft Co. structural damage tolerance analysis, crack propagation rates were measured in humid air from 10^{-8} to 10^{-3} mm/cycle of several high strength martensitic steels at stress ratios of $R=0.1$ and $R=0.5$. Increasing the stress ratio was found to decrease the threshold stress intensity. Increasing the tensile yield material strength in these quench and tempered steels resulted in a nearly linear inverse relationship with the threshold stress intensity. The threshold stress intensity appeared to be independent of the fracture toughness of the alloy steel. (6 refs.)

73175 Plastic deformation in the course of fracture of ferrite-pearlitic steels. M.N.Georgiev, V.Yu.Dogadushkin, N.Ya.Mezhova, V.K.Minaev, L.P.Strok (All-Union Sci.-Res. Inst. of Railway Engrs., USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.571-5 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
X-ray and electron fractography methods were used to study some characteristics of plastic deformation of fractured surfaces of steels with the ferrite-pearlite structure as a function of the nature of loading and test temperature. The results indicated that fatigue fracture was a very brittle fracture from the energy point of view. Cooling indicated the occurrence of mechanisms typical of single loading and stopping of the processes of ordering of the dislocation structure. (6 refs.) *A.T.*

73176 Hydrides and delayed hydrogen cracking in zirconium and its alloys. D.O.Northwood, U.Kosasih (Dept. of Engng. Materials, Univ. of Windsor, Windsor, Ontario, Canada).
Int. Met. Rev. (GB), vol.28, no.2, p.92-121 (1983).
A critical review is presented of published data on hydrogen, hydrides, and delayed hydrogen cracking (or hydrogen-induced delayed cracking, HIDC) in zirconium and its alloys. It is shown that factors such as solution temperature, cooling rate, and applied or residual stresses greatly affect the hydride morphology and orientation. The most detrimental hydride morphology is shown to be that when the hydride is oriented normal to the applied stress and has the morphology of a continuous sheet. Although knowledge of the mechanism(s) of delayed hydrogen cracking has improved greatly in the past five years, further research is needed to provide a better understanding of the process. The review concludes with a discussion of delayed hydrogen cracking in the practical case of nuclear-reactor pressure tubes, and presents possible remedies to ensure no further reoccurrence of the phenomenon in commercial reactors. (143 refs.)

73177 Fragmentation behavior of Armco iron and HF-1 steel explosive-filled cylinders. W.Mock,Jr., W.H.Holt (Naval Surface Weapons Center, Dahlgren, VA, USA).
J. Appl. Phys. (USA), vol.54, no.5, p.2344-51 (May 1983).
The fragmentation response of explosive-filled cylinders of Armco iron and HF-1 steel with two heat treatments has been determined. The cylinders were filled with cast-in-plane composition B explosive and detonated. At least 99% of the metal mass was recovered in all the experiments. The recovered fragments had both brittle and shear fracture surfaces. The average fragment mass for the Armco iron and HF-1 steel experiemnts was 6.3 and 0.9 g, respectively. Average engineering radial strain values for the fragments were 0.35 and 0.12 for Armco iron and HF-1 steel, respectively. A scheme was devised for characterizing the recovered fragments according to their cylindrical and fracture surfaces. Fragment mass distributions are presented for the characterized fragments. (11 refs.)

73178 The effect of non-uniform bending deformation on the stability of circumferential growth of through-wall cracks in brass tubes. E.Smith, M.J.Wilding (Manchester Univ., Manchester, England).
J. Mech. & Phys. Solids (GB), vol.31, no.3, p.223-9 (1983).
Experimental results on the stability of circumferential growth of through-wall cracks in brass tubes, show that non-uniform bending can adversely affect the crack stability criterion. The results are relevant to the important technological problem of crack stability in 304 stainless steel pipes used in Boiling Water Reactors. (3 refs.)

73179 Response of cracks in structural materials to short pulse loads. H.Homma, D.A.Shockey (Dept. of Metall. & Fracture Mech., SRI Internat., Menlo Park, CA, USA), Y.Murayama.
J. Mech. & Phys. Solids (GB), vol.31, no.3, p.261-79 (1983).
Cracks in single-edge-notched strip specimens of 4340 steel, 1018 steel, and 6061-T651 aluminum were loaded by tensile pulses of various amplitudes and durations to determine critical stresses for crack instability. The results were not well described by static fracture mechanics, but were in accord with behavior inferred from considerations of crack-tip stress intensity histories. (21 refs.)

73180 Dynamic fatigue of brittle materials containing indentation line flaws. B.L.Symonds, R.F.Cook (Dept. of Appl. Phys., School of Phys., Univ. of New South Wales, Kensington, Australia), B.R.Lawn.
J. Mater. Sci. (GB), vol.18, no.5, p.1306-14 (May 1983).
A study is made of the dynamic fatigue response of brittle materials containing indentation-induced line flaws. The theoretical fracture mechanics of 'median' crack evolution to failure under applied tension are first developed, with special emphasis on the role of residual contact stresses. In particular, it is shown that use of fatigue curves to evaluate the exponent in an assumed power-law crack velocity function may result in systematic error, by as much as a factor of two, if proper account is not taken of this residual contact contribution. Data from strength tests on soda-lime glass bars in water, using a tungsten carbide cutting wheel to introduce the median pre-cracks, confirm the basic predictions. The results suggest that extreme care needs to be exercised when using surfaces with a contact history, e.g. as with machining damage, in fatigue test programmes for materials analysis. (25 refs.)

73181 The influence of morphology and molecular weight on ductile-brittle transitions in linear polyethylene. N.Brown (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA), I.M.Ward.
J. Mater. Sci. (GB), vol.18, no.5, p.1405-20 (May 1983).
The tensile behaviour of linear polyethylene was examined over a wide range of temperatures. Samples were prepared from low and medium molecular weight polymer with different morphologies, by varying the initial crystallization conditions. It was found that the temperature of the ductile-brittle transition was markedly different for different samples. In particular, low molecular weight polymer crystallized at a low degree of supercooling, showed brittle behaviour over most of the temperature range, with a ductile-brittle transition near to room temperature. Rapidly quenched material, where the degree of supercooling is high, showed a very low ductile-brittle transition temperature, especially in high molecular weight polymer. The reasons for these differences in behaviour are discussed both at a phenomenological level and in terms of known structural differences between the different materials examined. (20 refs.)

73182 Impact strength of En8 steel diffusion bonds. C.E.Thornton, E.R.Wallach (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
J. Mater. Sci. (GB), vol.18, no.5, p.1433-42 (May 1983).
The use of diffusion bonding for the joining of steel is not widespread due partly to the large number of alternative welding processes and partly to a lack of information on mechanical properties of the resultant bonds. Data are provided on both tensile and impact properties of diffusion bonds in a plain carbon steel containing 0.4% C. Several hypotheses are proposed for the observed low impact properties and one of these, the presence of a planar layer of ferrite at the bond line, is discounted. (9 refs.)

73183 On the correlation between solid-particle erosion and fracture parameters in SiC. J.L.Routbort, Hj.Matzke (European Inst. for Transuranium Elements, Karlsruhe, Germany).
J. Mater. Sci. (GB), vol.18, no.5, p.1491-6 (May 1983).
The fracture toughness, K_{Ic}, for a hot-pressed SiC and three types of reaction-bonded SiC has been measured using the Hertzian indentation technique with spherical indentors whose radii varied from 2.5 to 10 mm. Excellent agreement between the toughness measured by this technique and the published K_{Ic} value measured using double torsion is obtained for the hot-pressed SiC. The Vickers hardness, H, which was also measured and K_{Ic} have been used to predict the solid-particle erosion rate, ΔW, given by $\Delta W \propto H^a K_c{}^b$ where the values of the exponents a and b depend on the details of the erosion model. The predicted rates are not in agreement with the measured rates. This discrepancy is probably due to the fact that the models are insensitive to microstructure. (16 refs.)

73184 Some aspects of crack growth and failure in fibre reinforced composites. J.G.Morley (Wolfson Inst. of Interfacial Technol., Univ. of Nottingham, Nottingham, England).
J. Mater. Sci. (GB), vol.18, no.5, p.1564-76 (May 1983).
A theoretical analysis, previously developed to deal with the mechanics of matrix cracking in unidirectional composites and with transverse ply cracking in cross ply laminates, has been developed further to deal with the tensile failure of unidirectional fibrous composites in which the fibres have a known distribution of strengths. It is proposed that, under the application of a tensile load, stable transverse cracks are formed which originate from regions of initial damage and which become unstable at some critical strain value. The model takes account of various parameters including the interfacial fibre/matrix debonding energy, the residual frictional shear strength of the debonded interface and the elastic properties of fibres and matrix. The relevance of the model to the study of delayed fracture in fibrous composites is discussed. The modification of this model is used to predict the initial cracking strains for a wide range of CFRP laminate geometries and initial crack size. Some aspects of the mechanics of crack extension across interply interfaces are discussed. (10 refs.)

73185 Fracture toughness/Young's modulus correlation for low-density fibrous silica bodies. D.J.Green (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.288-92 (April 1983).
Fracture toughness and static Young's modulus were measured for the low-density silica fiber materials used as tiles in the thermal protection system of the Space Shuttle. The fracture behavior was found to be in excellent agreement with a previously formulated micromechanical model (D.J. Green et al. see ibid., vol.65, no.3, p.138-41, 1982) and allowed both (density) classes of tile material to be correlated to a single function. A similar correlation was also found between strength and Young's modulus, which is the basis of a nondestructive evaluation test for these materials. It was shown that the value of Young's modulus determined from a dynamic test can be substantially greater than that determined in a static mechanical test. This effect must be taken into account in the correlation. Finally, it was also determined that these materials have significant variations in K_c, both within and between production units, so that the strength variability in these materials is dependent on both fracture toughness and flaw-size variations. (18 refs.)

73186 Relation of load to radial crack length for spherical indentations in hot-pressed ZnS. H.P.Kirchner, J.A.Ragosta (Ceramic Finishing Co., State College, PA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.293-6 (April 1983).
Hot-pressed ZnS was indented by spherical indenters of various radii. The relation of the load (P) and radial crack length (c_r) was better modeled by $P \propto d_i c_r{}^{1/2}$, where d_i is the indentation diameter, than by $P \propto c_r{}^{3/2}$. (17 refs.)

73187 Mechanical properties of sintered and nitrided laser-synthesized silicon powder. S.C.Danforth, J.S.Haggerty (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C58-9 (April 1983).
Pure and boron-doped silicon powders made by laser-heated gas-phase synthesis were densified by pressureless sintering and then nitrided. Modulus of rupture, hardness, and fracture toughness were measured for reaction-bonded Si_3N_4 samples made from these powders and for other standard materials for comparison. (12 refs.)

73188 X-ray diffraction studies of thermally shocked periclase. R.Vasudevan, H.Schneider, A.Majdic (Forschungsinst. der Feuerfest-Industrie, Bonn, Germany).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C68-9 (April 1983).
X-ray line profile analyses were used to study the effect of thermal shock on periclase (MgO) powders of varied sieve size. Thermal shock does not produce significant microfragmentation; the crystallite size appeared to be ≥ 150 nm. Microstrain is very low at grain sizes <0.10 mm, rises sharply up to ≈ 0.8 mm, and tends to saturate at $\approx 1 \times 10^{-3}$ at sieve sizes above 3 mm. (10 refs.)

73189 Comment on 'Toughening of glasses by metallic particles' [and reply]. S.C.Kunz (Composites & Polymer Mech. Div., Sandia Nat. Labs., Albuquerque, NM, USA), V.Kostic, P.S.Nicholson.
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.C73-4 (April 1983).
Comments on the work of V.V. Krstic et al. (see ibid., vol.64, no.9, p.499-504, 1981) concerning the toughening of glass by metallic particles. The value used for the thermal expansion coefficient of aluminium and the calculations of theoretical toughness values are criticized. V.V. Krstic and P.S. Nicholson give their reply. (3 refs.)

73190 Scanning electron microscope and ferromagnetic resonance investigations of fractured metglas 2826 alloy. R.S.Parashar, C.S.Sunandana, A.K.Bhatnagar (School of Phys., Univ. of Hyderabad, Hyderabad, India).
J. Non-Cryst. Solids (Netherlands), vol.55, no.2, p.301-5 (May 1983).
The authors have investigated the effect of various fracture treatments of metallic glass ribbons on the FMR spectra and have tried to evolve a method which results in minimum damage. Surface damage near the fractured specimens was examined through a scanning electron microscope. (6 refs.)

73191 Strength and toughness of various types of concrete. W.Koyanagi, K.Rokugo, Y.Uchida, H.Iwase (Faculty of Engng., Gifu Univ., Gifu, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.353, p.188-94 (Feb. 1983). In Japanese.
The failure characteristics such as strength and toughness of various types of concretes including steel fiber reinforced concrete and light weight concrete, were investigated in order to contribute to the establishment of evaluating methods of the characteristics. The following results were obtained. The shear strength measured from the direct double shear tests was proportional to the tensile strength. The absorbed energy ratio W_{cq}/W_{cp} in compression was found to be a useful parameter to indicate the failure behaviour of concrete, that is, how suddenly concrete loses its load carrying capacity after the maximum loads are reached. W_{cp} indicates the absorbed energy of a specimen up to the point of maximum load P_{max}, and W_{cq} the one up to the failure point, where the load descends to 1/3 of P_{max}. The ratio W_{cq}/W_{cp} was well related to the brittleness index, which is the ratio of compressive strength σ_c to tensile strength σ_t. The effect of steel fiber reinforcement on the improvement of concrete toughness was greater in flexure than in compression. (7 refs.)

73192 Fatigue life of concrete under varying repeated compressive load. S.Nishibayashi, K.Yamura, S.Inoue (Faculty of Engng., Tottori Univ., Tottori, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.353, p.202-7 (Feb. 1983). In Japanese.
In order to investigate the fatigue life of concrete under varying repeated load, several stress fatigue tests were performed. In these tests, concrete cylinder specimens were subjected to the repeated load in which load levels were selected as to be between a constant minimum stress level and five different maximum stress level S_j (72~82 percent of the ultimate static strength at each interval of 2.5%). The triangular-, normal-, uniform-, and exponential-distributions were used as the shape of the stress block for the varying repeated load. The order of the applied maximum stress level was selected at random. At each test condition, the sum of cycles ratio follows a logarithmic normal distribution. Miner's rule may possibly be applied to predict the fatigue life under varying repeated load in which the magnitude of stress is changed quite frequently. (7 refs.)

73193 Thermal shock resistances and fracture toughnesses of SiC and B_4C disks at elevated temperature. S.Sato, K.Tobita, M.Kurata.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.19-26 (1982).
Fracture mechanics properties for thermal shock are determined of five varieties of silicon carbides and a boron carbide at elevated temperature. The measurements are carried out using the disk testing method including the fracture toughness, thermal shock resistance and thermal shock fracture toughness. The obtained results are discussed with respect to the manufacturing conditions of the specimens. (10 refs.)

73194 Fracture mechanics properties for thermal shock of the mesophase pitch carbons during the graphitizing heat treatment process. S.Sato, M.Ishihara, O.Watanabe, N.Ogata.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.27-33 (1982).
The authors describe experimental results concerning the temperature dependencies of heat treatment on the strength and fracture toughness for thermal shock during the graphitizing heat treatment process of two types of high density and high strength graphite, called metaphite. The metaphites were recently produced from mesophase pitch with fine mosaic structures which were obtained by appropriate heat treatments for residual pitch in the oil cracking process. The examined specimens are the baked carbons and the graphitized ones of the hard carbon origin-MF301 and the soft carbon origin-MF306. The measured fracture mechanics properties include diametral compressive strength, mode I and II fracture toughness, thermal shock resistance and thermal shock fracture toughness by means of the disk testing method in addition to usual mechanical properties. (8 refs.)

73195 Thermal shock resistance and fracture toughness of graphite with different arrangements of coke grain size and porosity. S.Sato, M.Ishihara, Y.Inoue, S.Kiyono.
J. Fac. Eng. Ibaraki Univ. (Japan), no.30, p.35-42 (1982).
The authors discuss the fracture mechanics properties as two functions of the mean grain size G and the mean porosity P in three grades of electrode graphite, which were made from well defined grain arrangements. The fracture properties are measured primarily by means of a series of disk tests which include diametral compressive strength σ_{HC}, mode I fracture toughness K_{IC}, thermal shock resistance $\Delta(=\sigma_t k/E\alpha$, σ_t:tensile strength, k:thermal conductivity, E:Young's modulus, and α:coefficient of thermal expansion) and thermal shock fracture toughness $\nabla(=K_{Ic}k/E\alpha)$. Knudsen type expressions on G and P for Δ and ∇ are formulated and the optimum arrangement of coke grain size are discussed. (22 refs.)

73196 Compression testing and cracking of plain concrete. N.G.Shrive (King's Coll., Univ. of London, London, England).
Mag. Concr. Res. (GB), vol.35, no.122, p.27-39 (March 1983).
Flaws such as pores and voids are present in cement paste, and therefore in concrete. These flaws act as stress-raisers and cause the initiation of cracks in compressive stress fields. By analysing the stress state in compressive test specimens—recognizing that testing machines apply displacement conditions—and examining the stresses which may then exist around a spherical void, it is possible to explain the typical cracking patterns observed in such specimens. It is also possible to explain the cracking patterns and apparent changes in strength observed under externally applied biaxial stress conditions. This analytical work is restricted to elastic isotropic media and spherical voids, so the potential effect of aggregate particles is examined. Aggregate is shown to cause stress variation on a local basis, which may aid crack formation close to aggregate particles, and the extension of cracks around aggregate/cement paste interfaces. (15 refs.)

73197 Grain boundary sliding and stress concentration during creep. T.Watanabe (Dept. of Materials Sci., Tohoku Univ., Sendai, Japan).
Metall. Trans. A (USA), vol.14A, no.4, p.531-45 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
Importance of grain boundary sliding to creep intergranular fracture is focused. Previous metallographic and fractographic studies of creep intergranular fracture on metal bicrystals and polycrystals are briefly reviewed in order to show the close relationship between grain boundary sliding and fracture. Deformation ledge and migration irregularity are shown to be potential sites of stress concentration and crack nucleation on sliding grain boundaries without particles. The effect of grain boundary structure on creep intergranular fracture is discussed on the basis of the effect of grain boundary structure on sliding, the contribution of sliding to the overall creep deformation, and a sliding-fracture diagram. Recent observations of the effect of grain boundary structure on creep intergranular fracture on alpha Fe-Sn alloy polycrystals are shown. (55 refs.)

73198 High temperature embrittlement of Ni and Ni-Cr alloys by trace elements. C.L.White, J.H.Schneibel, R.A.Padgett (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.595-610 (April 1983). (Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure', Dallas, TX, USA, 14-18 Feb. 1982).
The effects of Sb, S, and Zr additions on the creep properties of Ni and Ni+20 pct Cr are reported. Antimony and tin additions (~1 wt. pct) induce extensive grain boundary cavitation in nickel, while smaller antimony additions had little effect on Ni+20 pct Cr. Addition of 0.11 pct Zr to Ni+20 pct Cr greatly inhibited grain boundary cavitation and reduced its Coble creep rate. Auger electron spectroscopy of cavitated specimens provided direct evidence of impurity segregation to cavity surfaces. Residual sulfur segregated most strongly, and was observed on cavity surfaces in all cavitated specimens. Tin segregated somewhat less intensely than sulfur, and antimony segregated only slightly. Segregation of antimony and sulfur to uncavitated portions of Ni+1 pct Sb grain boundaries was also observed. These results are discussed in terms of segregation effects on energetic and transport properties of the grain boundaries and cavity surfaces. (64 refs.)

73199 Analyzing statistical variability of fracture properties. T.A.Bishop, A.J.Markworth, A.R.Rosenfield (Battelle-Columbus, Columbus, OH, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.687-93 (April 1983).
A recently developed statistical analysis is applied to the estimation of lower-bound Charpy V-notch impact energies. Scatter of the impact-energy-absorption data, at any given temperature, is described using a two-parameter Weibull distribution, with the parameters allowed to vary with temperature. Values for the parameters are obtained using standard linear-regression techniques. As a result, the analysis naturally yields the temperature dependence of the *p*th percentile of the impact-energy distribution. Data with both large and small scatter are analyzed using this procedure. (13 refs.)

73200 The enhancement of hydrogen attack in steel by prior deformation. S.F.Clugston, J.R.Weertman (Dept. of Materials Sci. & Engng., Northwestern Univ., Evanston, IL, USA), P.G.Shewmon.
Metall. Trans. A (USA), vol.14A, no.4, p.695-9 (April 1983).
An investigation has been made of the cause of enhancement of hydrogen attack (HA) by prior cold working. Bars of 1020 Si-killed steel deformed in three point bending were found to contain microcracks at ferrite/ferrite grain boundaries containing cementite inclusions and at ferrite/pearlite boundaries. Very long cementite plates crack, but shorter cementite inclusions ($\leq\simeq 2\ \mu m$) suffer decohesion from the matrix at or near the inclusion ends. The observed anisotropy of microcracking with respect to grain boundary orientation and sign of the deformation stress can be understood in terms of the stress state at the inclusion/matrix interface during deformation. The microcracks are not eliminated by an annealing treatment which is known to cancel the effect of deformation on HA. It is concluded that residual stresses arising from the difference in deformability between cementite particles and matrix are responsible for the influence of deformation on HA. (12 refs.)

73201 Effects of hydrogen on near-threshold crack propagation in niobium. S.Fariabi, A.L.W.Collins, K.Salama (Univ. of Houston, Houston, TX, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.701-7 (April 1983).
The effects of hydrogen on near-threshold fatigue crack growth rate have been investigated in niobium at room temperature. Fatigue tests were performed on a hydrogen-free specimen as well as specimens containing hydrogen in solid solution and in the form of hydride. Specimens were tested using a tension-tension loading cycle at a frequency of 4 Hz and two load ratios of 0.05 and 0.4. The results show that the threshold stress-intensity factor ΔK_{th} decreases with the addition of hydrogen and reaches a minimum at a hydrogen concentration approximately equal to the solubility limit of hydrogen in niobium. As the hydrogen concentration exceeds the solubility limit, ΔK_{th} increases with the increase of the amount of hydrogen dissolved in the specimen. Analysis of this behavior suggests that stress-induced hydride cannot be responsible for the embrittlement of niobium with hydrogen, and dislocation-hydrogen interaction plays an important role in the embrittlement process. SEM metallography studies also confirm the importance of dislocation in the embrittlement of niobium by hydrogen. (37 refs.)

73202 Crack propagation of high strength steels in a gaseous hydrogen atmosphere. M.Nakamura, E.-I.Furubayashi (Tsukuba Labs., Nat. Res. Inst. for Metals, Ibaraki, Japan).
Metall. Trans. A (USA), vol.14A, no.4, p.717-26 (April 1983).
The crack propagation behavior in delayed fracture was investigated at room temperature under pressure up to 784 kPa of hydrogen gas for high strength steels with the tensile strength of 1500 or 2000 MPa. For specimens with the tensile strength of 1500 MPa, the crack propagation rate *da/dt* increased with C content from 0.21 to 0.42 wt. pct, and then it decreased with increasing C content up to 0.53 wt. pct. *da/dt* increased rapidly with Mn content from 0.009 to 0.84 wt. pct, and it increased gradually with Mn content from 0.84 to 2.13 wt. pct. The permeation flow of hydrogen from the crack tip surface could be quantitatively estimated from the dependence of *da/dt* upon the hydrogen pressure based on the simple assumption. In addition to the ground boundary embrittlement caused by tempering and/or hydrogen, the permeation flow of hydrogen was used to explain qualitatively the dependence of *da/dt* upon C or Mn content. (28 refs.)

73203 S-N curve inversion of nickel-base superalloy at elevated temperature. R.R.Paulson, L.G.Fritzemeier, J.K.Tien (Henry Krumb School of Mines, Columbia Univ., New York, NY, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.727-31 (April 1983).
Stress controlled tensile fatigue behavior of a representative nickel-base superalloy, Udimet 115, was studied at 760°C and 1 Hz while holding the maximum stress constant. An inversion in the S-N curve was observed within 10^4 cycles, in contrast to normal S-N behavior at ambient temperatures. A detailed analysis of the strain response to a trapezoidal applied stress waveform indicated that the inversion is consistent with increasing creep strains due to increasing mean stresses. Fractographic observations were also found to be consistent with the inversion in that, at higher mean stresses, intergranular fracture replaced the usual stage II-type intragranular fracture associated with fatigue failure in these planar-slip alloys. The results are also discussed with respect to the three regimes of dynamic creep and the observed plastic increments and anelastic strains. (12 refs.)

73204 Microstructures and mechanical properties of hot isostatically pressed powder metallurgy alloy APK-1. T.L.Prakash, Y.N.Chari, E.S.Bhagiradha Rao, R.Thamburaj (Defence Metall. Res. Labs., Hyderabad, India).
Metall. Trans. A (USA), vol.14A, no.4, p.733-42 (April 1983).
The influence of hot isostatic pressing (HIP) and heat treatment parameters on the microstructure and mechanical properties of powder metallurgy alloy APK-1 (a low carbon modification of Astroloy) has been investigated. Poor mechanical properties result if carbide networks are present along the prior particle boundaries (PPBs). These networks which form during powder consolidation can be avoided by manipulating HIP parameters. Heat treatments which produce a large volume fraction of fine γ' make this alloy susceptible to environment-assisted tensile embrittlement around 760°C. (10 refs.)

73205 The effect of temperature, specimen size, and geometry on the fracture toughness of a 3 pct NiCrMoV low pressure turbine disc steel. N.B.Shaw, G.M.Spink (Sci. Services Dept., CEGB, Harrogate, England).
Metall. Trans. A (USA), vol.14A, no.4, p.751-9 (April 1983).
The variation of fracture toughness with temperature and specimen size of a 3 pct NiCrMoV LP disc steel has been investigated over the temperature range −100 to +100°C using compact tension and single-edge-notched bend geometries. A number of large 'half-disc' three point bend specimens were also tested. Toughness increased up to a transition temperature coinciding with the onset of stable ductile tearing prior to instability. Below this temperature fracture could be described by established linear elastic or post yield fracture analyses. Above this temperature failure was by plastic collapse. The transition temperature decreased with decreasing specimen size, and at similar thicknesses was lower for the bend geometry than for the compact tension so that it was not possible to predict the fracture behavior of the full size service component from small scale tests in the transition region. A further complicating feature was the extreme scatter of some duplicate test results below the transition temperature. The implications for toughness testing in the transition region are discussed. The data obtained have been combined with published data for similar steels to derive an equation which describes the variation of fracture toughness with temperature for steels of this type. (18 refs.)

73206 Some solid-state properties of blends of polyethylene terephthalate and polyamide-6,6. M.R.Kamal, M.A.Sahto (Dept. of Chem. Engng., McGill Univ., Montreal, Quebec, Canada), L.A.Utracki.
Polym. Eng. & Sci. (USA), vol.22, no.17, p.1127-37 (mid-Dec. 1982). (Second Mini-Symposium on Polymer Blends, 'Polyblends '82', Montreal, Canada, 20 April 1982).
Polymer blends incorporating polyamide-6,6(PA) and polyethylene terephthalate (PET) and having the following PA wt.% concentrations were prepared: 0, 5, 10, 25, 30, 35, and 100. Samples were obtained by molding in a reciprocating-screw injection-molding machine. The samples were annealed to minimize frozen-in stresses without increasing the crystallinity level in the material. Melting and heat-of-fusion data, obtained with the differential scanning calorimeter, suggest an overall increased crystallinity in the blends, as indicated by a significant excess heat of fusion. Whereas the neat polymers exhibited ductile failure under both tensile and impact testing conditions, the blends showed brittle behavior. The abrasion resistance of the blends was inferior to that observed for PET but higher than the resistance of PA. (51 refs.)

73207 High temperature mechanical behaviour of silicon nitrides (Si_3N_4, Sialon). G.Orange, G.Fantozzi (Groupe d'Etude de Metall. Phys. et de Phys. des Materiaux, Villeurbanne, France).
Rev. Chim. Miner. (France), vol.20, no.1, p.20-36 (1983). In French.
Nitrogen ceramics, and especially silicon nitride ceramics, have a unique combination of properties which has encouraged their potential application as structural components in high temperature engineering applications. The high temperature mechanical behaviour of different varieties of silicon nitride: a reaction-bonded silicon nitride has been determined. (RBSN), a hot-pressed silicon nitride (HPSN), and a pressureless sintered Sialon. The elastic modulus, the flexural strength and the fracture toughness have been measured up to 1500°C, in inert and in air atmosphere. The mechanical behaviour of these different varieties is discussed with regard to the microstructure. (28 refs.)

73208 Sintered boron—production and properties. II. Mechanical and thermophysical properties. R.A.Andrievskii, I.A.Bairamashvili, L.N.Dement'ev, P.V.Zubarev, A.G.Lanin, Yu.I.Soloev, M.L.Taubin, M.A.Fedotov (Moscow Inst. of Fine Chem. Technol., Moscow, USSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.702-5 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.24-7 (Sept. 1982). [received: March 1983]
For pt.I see ibid., vol.27, no.8, p.27 (1982). Specimens of 15-35% porosity were produced by sintering in argon. Hardness in the temperature range 20-1000°C was determined using a modified IMASh-300 machine. Compressive strength σ_c measurements were made on 3-mm-square, 6-mm-high specimens. Transverse rupture strength σ_{tr} in the temperature range 20-1900°C was measured in a vacuum corresponding to $1.3.10^{-4}$ Pa. Diametral compression ('indirect extension') was studied on 12-mm-diameter, 3- to 6-mm-high specimens at room temperature. Young's modulus was measured by an ultrasonic method at room temperature. Measurements of the coefficient of linear expansion (CLE) α_t of 3-mm-square, 12-mm-long specimens were made. The thermal properties (thermal conductivity λ, heat capacity C_p, and thermal diffusivity *a*) of 12-mm-diameter, 15-mm-high cylindrical specimens were determined in a dynamic calorimeter. (17 refs.)

73209 Laws of plastic strain and fatigue fracture of metals in torsion. V.T.Troshchenko, V.I.Dragan (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.569-76 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.3-10 (May 1982). [received: May 1983]
Three periods are distinguished in fatigue crack propagation of steels. The first period is connected with crack propagation along or across the specimen axis, with shear stresses being determining in this case. The crack propagates in the second period at a 45° angle to the specimen axis and its growth is governed by normal stresses. In the final period the crack again begins to grow in the plane of the maximum shear stresses. This is followed by final fracture. The amount of plastic strain per cycle during the plastic-strain stabilization stage at stresses exceeding the endurance limit is determined by the dimensions and number of microcracks. Plastic strain, leading to the appearance of a closed hysteresis loop in the coordinates stress-strain during cyclic loading, can be used as a measure of fatigue damage at the stage of fatigue crack nucleation. (5 refs.)

73210 Allowing for strength anisotropy in estimating the rupture strength of actual tubes in a plane stress state. E.A.Myakotin (Inst. of Mech., Moscow State Univ., Moscow, USSR).
Strength Mater. (USA), vol.14, no.5, p.589-93 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.20-3 (May 1982). [received: May 1983]
Previous results of creep rupture tests of high-strength steel tubes, subjected to low-temperature thermomechanical treatment (LTMT), in axial and peripheral tension showed that not only was strength as a whole increased, but strength anisotropy also appeared—the ratio of axial to peripheral strength ranged from 1.25 to 2.5, depending on the conditions of the LTMT. In the present work the feasibility is examined of improving the accuracy of predictions of the high-temperature rupture strength of thin-walled tubes in complex stress states by allowing for strength anisotropy. (7 refs.)

73211 Influence of the type of solidification of a cast nickel alloy of the ZhS6 family on its high temperature strength. E.R.Golubovskii, I.P.Bulygin, L.N.Timofeeva, E.Yu.Shershenkova.
Strength Mater. (USA), vol.14, no.5, p.635-41 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.59-64 (May 1982). [received: May 1983]
The authors present the results of an investigation of the stress-rupture strength and ductility of cast ZhS6U alloy with equiaxial and directed structures. Directed solidification of ZhS6U alloy not only increased the average values of the characteristics of high temperature strength but also reduced their dispersion in comparison with the similar characteristics in the equiaxial structure. In addition, with an increase in the test base and temperature, the advantage in high temperature strength of the directed structure increased. (6 refs.)

73212 Discreteness and self-similarity of failure in stable fatigue crack growth. V.S.Ivanova (A.A. Baikov Inst. of Metall., Moscow, USSR).
Strength Mater. (USA), vol.14, no.5, p.675-84 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.91-9 (May 1982). [received: May 1983]
On the basis of approaches of linear fracture mechanics and the theory of self-similarity it has been shown that the effect of the external factors on the cracking resistance criteria can be reduced to a single factor, i.e. the degree of constraint of plastic deformation characterized by parameter $Q=(\sigma_{11})_{max}/\sigma_T$. As the criterion controlling the transition from quasielastic self-similar to elasto-plastic self-similar crack propagation, it is proposed to use the Huber-Mises criterion. The K_{I*}-m diagram linking the threshold values of K_{I*} with coefficient m which characterizes the crack growth retardation capability has been proposed. The regions of the K_{I*} values and of the corresponding values of m which correspond to self+similar elastoplastic crack growth have been defined. (25 refs.)

73213 Application of the kinetic strength concept to determination of the longevity of specimens with a stress raiser under static load. A.I.Ravikovich.
Strength Mater. (USA), vol.14, no.5, p.690-4 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.103-7 (May 1982). [received: May 1983]
The author examined one of the possible approaches to the determination of the longevity of specimens with a stress raiser by computational means on the basis of the kinetic strength concept. It is known that the kinetic characteristics obtained in processing experimental data on the longevity of smooth specimens can be used to calculate the longevity of specimens with a stress raiser. A method of computing the longevity of these specimens under cyclic loading is proposed. The results of experimental investigation of the longevity of smooth specimens and specimens with a stress raiser under cyclic tension at a frequency of 7.45 cycles/min and test temperatures of 423 and 448K are presented. A comparison is made between computed and experimental data on the longevity of specimens with a stress raiser. (4 refs.)

73214 Dynamic crack growth during pop-in fracture in 7075 aluminum alloy. T.Kishi, T.Ohira (Inst. of Interdisciplinary Res., Univ. of Tokyo, Tokyo, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.255-63 (April 1983).
The acoustic emission source characterization was carried out to examine the dynamic information about the microfracture processes. The response function of specimens and transducer was obtained experimentally by use of breaking pencil lead as a reference simulated AE source, and the source waves were determined in terms of crack volume-time functions explicitly through a time-domain deconvolution. This method was tested by measuring the acoustic waveforms from pop-in crack growth in 7075-T6 aluminum alloy. The lifetime of each pop-in deduced was about 0.9-2.8 μs, and the crack volumes obtained by this method were consistent with fractographic observations. From these results, the maximum crack velocity was shown to reach about 1000 m/s. (17 refs.)

73215 The interaction of dislocation with Θ'-precipitates in a Al-2.8% Cu-alloy during fatigue tests.
Z. Metallkd. (Germany), vol.74, no.5, p.300-6 (May 1983). In German.
Polycrystalline samples of precipitation hardened Al-2.8% Cu-alloys with Θ'-particles were fatigued in reversed-stress tests in order to examine the plastic deformation behavior. The dislocation hardening mechanisms were studied in the transmission electron microscope. By interaction of dislocations with Θ'-precipitates dislocation networks were formed in the matrix-precipitate interphase boundaries. The dislocations can pass the precipitates by climbing cross slipping of by splitting off a dislocation loop (Orowan loop). These rings ($\mathbf{b}=a/2\langle 011\rangle$) form networks in the interphase boundaries. The interphase plains $(001)_a \| (0010)_{\Theta'}$ of the Θ'-precipitates are the weak spots of the structure, allowing the fatigue cracks to grow in these {001}-planes. (20 refs.)

73216 Determination of fracture-mechanic properties by using the near-field of dynamically loaded cracks. C.Zimmermann (Staatliche Materialprufungsanstalt, Univ. Stuttgart, Stuttgart, Germany).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.17/1-11 In German.
The dynamic changes to which the material under crack-causing stress is subjected can be measured by using the stress intensity factor K_I. Research has been projected to investigate the process of crack growth as a function of time and to evaluate K_I. (12 refs.) *G.R.S.*

73217 Investigation into the yield behaviour in the area close to the crack tip of a fine-grained structure steel. H.G.Rumpf, O.Schadel (Tech. Uberwachungsverein, Bayern, Munchen, Germany).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.18/1-15 In German.
The effect of various forms of notches in steel specimens on impact toughness has been studied and results are presented in the form of curves at temperatures from −120 to +80 deg.C. Microphotographs are shown of corrosion and erosion affected areas close to the crack. (16 refs.) *G.R.S.*

Symposium on 'The Role of Trace Elements and Interfaces in Creep Failure' .... See Entry 69779

Transferability of post yield fracture data from small scale to large scale specimens and plant components .... See Entry 70646

Influence of cladding on the linear elastic RPV analysis during a loss-of-coolant accident .... See Entry 70647

Numerical simulation of post-yield fracture mechanics experiments and the possibility of application of results to plant components .... See Entry 70695

A methodology for characterizing brittle fracture of solid waste forms in accidental impacts .... See Entry 70703

Creep and rupture strength with a nonuniform stress state .... See Entry 71405

Overload retardation models of fatigue crack growth .... See Entry 71460

Role of geometry in plastic instability and fracture of tubes and sheet .... See Entry 71467

Brittle fracture of plates in tension—relative significance of boundary reflected body and Rayleigh waves .... See Entry 71479

Thermodynamics of the propagation process of quasibrittle cracks .... See Entry 71485

Dynamic characters of anisotropic materials for stress distributions .... See Entry 71503

The role of microcracking during crack growth in brittle materials .... See Entry 72037

A fracture mechanics analysis of indentation-induced Palmqvist crack in ceramics .... See Entry 72038

Multiplicity of causes of grain-boundary fracture .... See Entry 72039

The discreteness of fracture .... See Entry 72040

Comment on the article by G.I. Barenblatt 'The discreteness of fracture' .... See Entry 72041

Comment on the discreteness of fracture .... See Entry 72042

Reply to G.I. Barenblatt's comments [on 'the discreteness of fracture'] .... See Entry 72043

Preparation and properties of SmB_6 and SmB_4 single crystals .... See Entry 72980

Some mechanical and electrochemical properties of electroless nickel .... See Entry 73015

The kinetics of densification of binary titanium-chromium diboride with copper-nickel binder .... See Entry 73057

Effect of some force factors on the rigidity characteristics of a magnesium-boron fiber composite material .... See Entry 73127

The shape of stress relaxation curves and the mechanical equation of state in molybdenum .... See Entry 73128

Strain mechanisms in grey cast iron .... See Entry 73134

Effect of vacuum-treatment on mechanical properties of W-Ni-Fe heavy alloy .... See Entry 73139

Straw-reinforced polyester composites .... See Entry 73141

Crack and cavity nucleation at interfaces during creep .... See Entry 73145

The effects of trace impurities on the ductility of a Cr-Mo-V steel at elevated temperatures .... See Entry 73147

The effect of cerium on high temperature tensile and creep behavior of a superalloy .... See Entry 73149

The effect of shear bands on service properties of Ti-6Al-2Sn-4Zr-2Mo-0.1Si forgings .... See Entry 73151

Damage during friction and dislocation structure of gold-platinum solid solutions .... See Entry 73219

Effect of simulated body environments on crack propagation in alumina .... See Entry 73234

Anomalous corrosion of hydrogen-containing ferritic steels in aqueous acid solution .... See Entry 73262

The cohesive and adhesive strength of ice [on metal substrates] .... See Entry 73271
Surface melting of a medium carbon steel by laser treatment . See Entry 73272
A fundamental study of laser transformation hardening .... See Entry 73275
Micro-hardness of non-irradiated uranium dioxide .... See Entry 73292
Effect of indenter geometry on controlled-surface-flaw fracture toughness .... See Entry 73293
Examination of delayed fracture tests on prestressing steels ....See Entry 73294
Prediction of the collapsing pressure of glass fiber-reinforced plastic membranes by the acoustic emission method ....See Entry 73306
Computation of curves of residual-stress relaxation at normal and elevated temperatures .... See Entry 73307
Scanning electron microscopy studies on mechanism of rubber tear ....See Entry 73310

81.40P Friction, lubrication, and wear

(see also 62.20P Tribology)

73218 Tribological properties of sintered polycrystalline and single-crystal silicon carbide. K.Miyoshi, D.H.Buckley (NASA-Lewis Res. Center, Cleveland, OH, USA), M.Srinivasan.
Am. Ceram. Soc. Bull. (USA), vol.62, no.4, p.494-500 (April 1983).
Tribological studies and X-ray photoelectron spectroscopy analyses were conducted with sintered polycrystalline and single-crystal SiC flat surfaces in sliding contact with an iron pin at temperatures to 1500°C in a vacuum of 30 nPa. The results indicate that there is a significant temperature influence on both the friction properties and the surface chemistry of SiC. The surface revealed a low coefficient of friction. This is believed to be due to the presence of the graphite on the surface. At temperatures of 400° to 600°C, graphite and a copious amount of SiO_2 were observed on the polycrystalline SiC surface in addition to SiC. At 800°C, the amount of the SiO_2 decreased rapidly and the SiC-type silicon and carbon peaks were at a maximum intensity in the XPS spectra. The coefficients of friction were high in the temperature range of 400 to 800°C. SiC-type silicon and carbon peaks were seen on the SiC in addition to very small amount of graphite and SiO_2 at temperatures of 450°C to 800°C. The coefficients of friction were high over the entire temperature range to 800°C. Above 800°C, the concentration of graphite increases rapidly on both polycrystalline and single-crystal SiC surfaces, whereas concentration of the SiC-type silicon and carbon peaks decreases rapidly. The presence of graphite is accompanied by a significant decrease in friction. (33 refs.)

73219 Damage during friction and dislocation structure of gold-platinum solid solutions. N.I.Noskova, V.A.Pavlov, T.P.Bregman, E.A.Soldatova, L.I.Voronova, V.P.Polyakova, E.M.Savitskii (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.55, no.3, p.583-91 (March 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the mechanical strength and plastic properties, and of the friction coefficient. These were combined with the results of electron-microscopic investigations of the fine structure of gold-platinum alloys. The friction coefficient and nature of damage at a friction contact depended on the characteristics of the dislocation structure, formed as a result of deformation, on the degree of localization of strain, and on the nature of damage caused by static stretching of the alloys. (15 refs.) *A.T.*

73220 Antifriction properties of chromium alloys. E.A.Markovskii, I.M.Nedyukha, V.K.Sul'zhenko, N.A.Kachko, O.N.Samgina, O.V.Bakun (Inst. of Casting Problems, Acad. of Sci., Ukrainian SSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.737-41 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.63-8 (Sept. 1982). [received: March 1983]
An investigation was carried out under various specific loads into the effect of temperature on the coefficients of friction and wear intensity of unalloyed chromium, a basic, chromium-6% magnesia alloy, and several alloys produced by adding 0.5% of titanium, zirconium, vanadium, and niobium carbides to the basic alloy. It was found that the decisive factor determining the antifriction properties of chromium alloys at low and moderate temperatures was their level of ductility. It is concluded that alloying with very small amounts (0.5-1 wt.%) of carbides gives the best results, since it both increases the strength and load-carrying capacity of chromium and improves its antifriction properties, without significantly altering its cold-brittleness temperature. (10 refs.)

73221 Tribological properties of cast graphitic-aluminium composites. S.Biswas (Corporate Res. & Dev. Div., Bharat Heavy Electricals Ltd., Hyderabad, India), P.K.Rohatgi.
Tribology Int. (GB), vol.16, no.2, p.89-102 (April 1983).
Some of the tribological properties of cast graphitic-aluminium particulate composite materials are presented. Tests were designed to represent different running conditions, from mixed lubrication to almost dry. Two graphitic aluminium composites, the aluminium alloys on which they were based, and commercial-quality bronze were compared for friction characteristics in these tests. An attempt was made to compare their vibration amplitude characteristics due to stick-slip. Surface features of the mating components after the tests were completed are also presented. It was found that the graphite-aluminium composites perform the best of those tested, in terms of the above-mentioned characteristics, under the most severe running conditions. (16 refs.)

73222 Wear characteristics of composites: effect of fiber orientation. H.-W.Chang.
Wear (Switzerland), vol.85, no.1, p.81-91 (15 Feb. 1983).
Wear characteristics of continuous graphite fiber-epoxy composite were studied on a Falex wear tester by sliding composite rings with various fiber orientations against conforming steel blocks under normal pressure 126 lbf in^{-2} and a surface speed of 0.6 m s^{-1}. The highest wear rate was obtained when the fibers were oriented at 30° from the sliding direction. A good correlation was observed between wear rates and apparent interfacial temperature, and the correlation was qualitatively explained by the energy balance between mechanical energy to break the fibers and thermal energy to the samples. Attempts were also made to correlate viscoelastic properties of the composites with the wear rates by using the apparent interfacial temperatures. (9 refs.)

73223 The role of microstructure in the wear of selected steels. S.F.Wayne, S.L.Rice, K.Minakawa, H.Nowotny (Inst. of Materials Sci., Univ. of Connecticut, Storrs, CT, USA).
Wear (Switzerland), vol.85, no.1, p.93-106 (15 Feb. 1983).
Both AISI 1045 and 2.25Cr-1Mo steels were selected for their capacity to form various phase morphologies at given compositional states. Heat treatment was then performed to produce the desired two-phase (duplex) structure in both materials. The mating counterface to each test material was a 17-4 PH stainless steel in the martensitic condition. Compound impact wear tests were performed at relative transverse sliding velocities of 1 and 10 m s^{-1} with peak nominal contact stress maintained at 69 MPa for various numbers of repetitive load cycles. The formation and characterization of subsurface zones were studied by scanning electron microscopy and energy-dispersive X-ray analysis. Wear debris was inspected by powder X-ray diffraction. The impact wear resistance of AISI 1045 and 2.25 Cr-1Mo steels is dependent on transverse velocity. Variations in velocity lead to 'trade offs' between specimen and counterface 17-4 PH stainless steel wear which is evidenced in weight loss data and correlates with microstructural observations (subsurface zone formation) for each two-phase system. Wear debris analysis confirms the presence of mechanochemical material interaction between specimen and counterface with increasing transformation and oxidation at the higher transverse sliding velocity. (11 refs.)

73224 A study of wear characteristics of different materials. P.Divakar (Mech. Engng. Dept., Regional Engng. Coll., Warangal, India), B.Kotiveerachari, B.G.Krishna Reddy.
Wear (Switzerland), vol.85, no.2, p.151-61 (1 March 1983).
The wear characteristics of different materials including plastics were studied. The variation in mass and linear wear with normal load and speed was determined. An empirical relation was derived for the mass wear of brass sliding against steel in terms of the normal load. The variation in mass and linear wear with material hardness was investigated. Different sliding pairs were studied to assess a minimum wear rate. (8 refs.)

73225 On the wear of aluminium-corundum composites. K.Anand, Kishore (Dept. of Metall., Indian Inst. of Sci., Bangalore, India).
Wear (Switzerland), vol.85, no.2, p.163-9 (1 March 1983).
The effect of corundum particle content on the wear of aluminium was studied. Composites of different corundum contents were tested for their wear characteristics. Hardness and density measurements were made on specimens before and after test. Specimens were examined dy scanning electron microscopy in the as-compacted, sintered and worn states. The wear decreased as the oxide content increased, showing an optimum value at a composition range of 25 wt.% of corundum. The mechanism of reinforcement and its effect on the operative wear mode are discussed. (9 refs.)

73226 Effect of temperature on the cavitation erosion of cast iron. Y.Iwai, T.Okada (Dept. of Mech. Engng., Fukui Univ., Fukui, Japan), F.G.Hammitt.
Wear (Switzerland), vol.85, no.2, p.181-91 (1 March 1983).
Vibratory cavitation erosion tests of gray cast iron, together with tests of tool steel and 316 stainless steel for comparison, were performed at various water temperatures and horn amplitudes under a suppression pressure of 1 bar. The erosion processes for cast iron under the highest temperatures used (200 and 230°F, i.e. 93 and 110°C) are similar to those at room temperature. For each of the materials tested, the maximum weight loss rate increases, shows a peak and then decreases with increasing temperature. However, the maximum damage temperature for cast iron decreases with amplitude, i.e. 200, 170 and 160°F (93, 77 and 71°C) for double-horn amplitudes of 1.0×10^{-3}, 1.38×10^{-3} and 1.78×10^{-3} in (25.4, 35.1 and 45.2 μm). The peak for tool steel and 316 stainless steel occurs at 160°F (71°C) regardless of amplitude. Liquid temperature effects for cast iron erosion were explained by considering the interrelation between corrosive action and mechanical action due to cavitation bubble collapse. (15 refs.)

73227 Subsurface damage during dry sliding wear of Al-Al_3Ni eutectic alloy. R.Salih Yaseen, E.S.Dwarakadasa, A.Razzaq Ismail (Dept. of Production Engng. & Metall., Univ. of Technol., Baghdad, Iraq).
Wear (Switzerland), vol.85, no.2, p.213-21 (1 March 1983).
Cylindrical Al-Al_3Ni eutectic alloy wear pins (10 mm in diameter) were slid against a polished steel surface in a pin-on-disc rotating machine under unlubricated conditions with bearing pressures of 6-60 kPa and a constant sliding speed of 70 m min^{-1}. Metallographic changes in the subsurface region of contact were examined by optical microscopy and microhardness measurements. In the bearing pressure range investigated the alloy exhibited 'mild' wear in two linear regions identified as pure 'oxidative' wear at low bearing pressures and oxidative with superimposed 'metallic' wear at higher bearing pressures. Plastic deformation and fragmentation of the Al_3Ni phase occurred under all bearing pressures. However, in composites prepared by unidirectional solidification containing large Al_3Ni particles fragmentation was insignificant. In all other specimens the size of the fragmented particles in the subsurface region of contact was about 5 μm irrespective of the bearing pressure. (10 refs.)

73228 Morphology of ductile metals eroded by a jet of spherical particles impinging at normal incidence. P.Veerabhadra Rao, S.G.Young, D.H.Buckley (Lewis Res. Center, NASA, Cleveland, OH, USA).
Wear (Switzerland), vol.85, no.2, p.223-37 (1 March 1983).
A detailed morphological study of the erosion of two metals (an aluminum alloy and copper) by normal impact of spherical glass erodent particles was conducted. Damage patterns were studied at several stages of erosion. Scanning electron microscopy and energy-dispersive X-ray spectroscopy were used and surface profile measurements were made. Transformations induced by the erosion process were also studied and the dynamics of the erosion are discussed. The morphology of the damage pattern is a manifestation of the flow pattern of erodent particles and it provides insight into possible mechanisms active at different stages of erosion. The simultaneous appearance of both radial tracks as well as concentric rings is believed to be reported for the first time. Wave crests are observed which contain an accumulation of metallic flakes. From morphological comparisons of the pits over a wide variation in driving gas pressure and time, a well-defined damage and erosion process is evident and preliminary analysis is advanced to explain the formation of the various damage patterns. (32 refs.)

73229 The unlubricated wear of flake graphite cast iron. P.W.Leach, D.W.Borland (Dept. of Metall., Univ. of Melbourne, Parkville, Victoria, Australia).
Wear (Switzerland), vol.85, no.2, p.257-66 (1 March 1983).
The wear behaviour of flake graphite cast iron was correlated with the microstructural parameters of graphite volume fraction and flake size using a pin-on-ring specimen configuration. Pin specimens of cast iron were prepared under carefully controlled melting and casting conditions to provide microstructures with variation in either carbon content or flake size but with the same type A graphite structure and pearlitic matrix. Mild and severe modes of equilibrium wear were identified, the predominant effect of both microstructural parameters being in the severe wear regime. Decrease in flake size and increase in carbon content are detrimental to the wear behaviour resulting in a marked increase in the severe wear rate and a decrease in the mild-to-severe transition load. (20 refs.)

73230 Vibratory cavitation tests at elevated temperature. Yu-Kang Zhou, Xushi Wang, F.G.Hammitt (Dept. of Mech. Engng. & Appl. Mech., Coll. of Engng., East Univ., Ann Arbor, MI, USA).
Wear (Switzerland), vol.85, no.3, p.319-29 (15 March 1983).
Vibratory cavitation erosion curves in tap water are presented for different materials, suppresion pressures, amplitudes and temperatures. At the highest temperatue tested (230°F (110°C)), erosion is still substantial. Damage is found to decrease with increasing temperature above the maximum damage temperature, at least to this temperature (230°F), for all materials tested. Amplitude plays a great role in maximum damage temperature, especially for cast iron. Two distinct maximum mean depth of penetration rate $MDPR_{max}$ points were found for 316 stainless steel and 1018 carbon steel at 230°F. There is a black oxide outer rim on each 1018 carbon steel specimen only at the highest temperature, which is probably due to corrosion effects at the highest temperature. (20 refs.)

73231 Ductility and the abrasive wear of an ultrahigh strength steel. W.M.Garrison, R.A.Garriga (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA).
Wear (Switzerland), vol.85, no.3, p.347-60 (15 March 1983).
Ploughing of material to either side of the grooves made by abrasive particles and single indenters was observed for both wear and single point cutting. The degree of ploughing decreases as the hardness of the material being tested increases. It is possible to incorporate ploughing into the usual equation for the volume abrasive wear rate by introducing a term $1\text{-}f$, where f is the fraction of a wear groove ploughed to either side of the abrasive particle but not removed from the surface. Although it is possible to relate $1-f$ to hardness through single point scratching experiments, there is evidence that $1-f$ could depend primarily on ductility and not on hardness. As an initial step in exploring the dependence of this ploughing term on the mechanical properties of the abraded material, a simple model of the abrasive wear process is proposed. The model is evaluated in terms of the abrasive wear and tensile properties of a low alloy steel heat treated to hardnesses ranging from 496 to 680 HV. (15 refs.)

73232 Subsurface hardening in erosion-damaged copper as inferred from the dislocation cell structure, and its dependence on particle velocity and angle of impact. D.Kuhlmann-Wilsdorf (Dept. of Materials Sci., Univ. of Virginia, Charlottesville, VA, USA), L.K.Ives.
Wear (Switzerland), vol.85, no.3, p.361-73 (15 March 1983).
Previously published measurements of the cell diameters d of dislocation cells underneath copper surfaces exposed to particle erosion were evaluated in terms of the subsurface stresses τ to which they correspond. These were compared with the elastic stresses expected underneath spherical indenters impacting on the surface with different speeds. The inferred stresses differ markedly from theoretical predictions, not only in regard to the dependence on speed and angle of impact but even in regard to their decay along the z axis, the direction normal to the surface. Instead of τ decreasing as z^{-n} with n continuously rising from 0 at a shallow depth to 2 at large depths, as predicted from elastic theory, the stresses follow a z^{-1} dependence throughout the measured range. All data are satisfactorily explained by the relationship $1/d=(7/z)v^{2/5} \sin \alpha \approx \tau/100$ (using MKS units), where v stands for the velocity of the impacting particles, namely rather irregularly shaped alumina particles 50 μm in diameter, and α is the angle of impact. (11 refs.)

73233 The interaction between two wearing surfaces. I. Copper sliding on Cu-Be and Cu-Be sliding on Cu-Be. M.D.Sexton (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Wear (Switzerland), vol.85, no.3, p.375-90 (15 March 1983).
An investigation of the interaction of the two components of a wear system with reference to the physical properties of both components is described. Copper sliding on Cu-Be and Cu-Be sliding on Cu-Be were studied using a ball-on-disc machine, Auger spectroscopy and microhardness measurements. The two systems are found to be qualitatively similar classic examples of severe wear. The wear of a Cu-Be disc sliding under a copper ball is, however, greater than the wear of a Cu-Be disc sliding under a Cu-Be ball. This is attributed to work hardening of the copper ball resulting from an interaction between the two wearing surfaces. Microhardness measurements show that the surface of a Cu-Be ball and a Cu-Be disc are not work hardened during a wear experiment. The surface of a copper ball is work hardened, however, and becomes significantly harder than the wear scar on a Cu-Be ball. As a result the Cu-Be disc wears at a faster rate when sliding under a copper ball than it does when sliding under a Cu-Be ball. (50 refs.)

Effect of surface roughness on the stress-strain state of rubbing bodies .... See Entry 71493

The dependence of the friction coefficient on the crystal structure of solids: physical principles .... See Entry 72044

Some mechanical and electrochemical properties of electroless nickel .... See Entry 73015

The kinetics of densification of binary titanium-chromium diboride with copper-nickel binder .... See Entry 73057

Subsurface plastic deformation in machining 6Al-2Sn-4Zr-2Mo titanium alloy .... See Entry 73163

On the correlation between solid-particle erosion and fracture parameters in SiC .... See Entry 73183

Some solid-state properties of blends of polyethylene terephthalate and polyamide-6,6 .... See Entry 73206

81.40R Electrical and magnetic properties (related to treatment conditions)

(see also 72.80 Conductivity of specific semiconductors and insulators; 74.70 Superconducting materials, 75.50 Studies of specific magnetic materials)

Changes in the magnetic properties of amorphous alloy $Fe_5Co_{70}Si_{15}B_{10}$ caused by thermomagnetic treatment and the dependence of these changes on the initial state of alloy .... See Entry 72630

Study of the high-temperature X-ray diffraction of a Fe-Cr-Co permanent magnetic alloy .... See Entry 72638

Structure formation in and magnetic properties of a P/M iron-chromium-cobalt alloy .... See Entry 72639

Magnetostriction of austenite in iron-nickel-manganese alloys and martensitic transition under the action of a strong magnetic field .... See Entry 72649

Dependence of the dielectric properties, porosity, and apparent density of quartz ceramic on the phase of composition .... See Entry 73047

Some properties of fine-grained mixtures of $ZrSiO_4$-ZrO_2 ...... See Entry 73048

Effect of sintering conditions on the microstructure and electromagnetic properties of Li-Mg-Mn ferrite memory elements .... See Entry 73049

Structure and properties of permeable fine-fiber materials produced from powders .... See Entry 73157

81.40T Optical properties (related to treatment conditions)

(see also 78.20 Optical properties and materials)

Some optical characteristics of powdered tellurites of rare-earth elements .... See Entry 72760

81.60 CORROSION, OXIDATION AND SURFACE TREATMENTS

73234 Effect of simulated body environments on crack propagation in alumina. K.E.Aeberli, R.D.Rawlings (Dept. of Metall. & Materials Sci., Imperial Coll., London, England).
J. Mater. Sci. Lett. (GB), vol.2, no.5, p.215-20 (May 1983).
Double torsion tests were carried out in Ringer's solution and air on plates of alumina used, for femoral ball prostheses. The presence of a liquid environment was found to displace the logarithmic V-K_1 curve (crack velocity against stress intensity factor) to lower K_1 values with respect to air. (16 refs.)

73235 The chemical composition of the T15K6 alloy subjected to diamond-electric polishing with applied vibration. V.V.Dragomir.
Izv. VUZ Mashinostr. (USSR), no.3, p.111-13 (1983). In Russian.
An account is given of an experimental study, with the aid of an electron microscope, of the chemical composition of the T15K6 solid alloy, with the samples subjected to diamond-electric polishing, with applied low-frequency vibrations. The results show that the chemical composition of the T15K6 samples under these conditions changes negligibly; moreover, this treatment increases the strength and working capacity of the cutting part of the instrument. (2 refs.) *Z.F.V.*

73236 Analysis of conditions for powder surface deposition by laser. A.G.Grigor'yants, Yu.N.Redkobordoyi, V.V.Shibaev, A.N.Safonov.
Izv. VUZ Mashinostr. (USSR), no.3, p.155-9 (1983). In Russian.
Employing a solution for the Stefan case, a dependence is derived for the conditions of laser treatment of a cross layer. A comparison of theoretical and experimental data shows that to obtain high-grade coatings, the rate of treatment should be substantially reduced, in which case the lower values correspond to higher powers. This is linked with a reduction of the heat transfer to the substrate material, as well as with a more complete observance of the approximations employed. (6 refs.) *Z.F.V.*

73237 The kinetics of surface craze growth in polycarbonate exposed to normal hydrocarbons. A.Priori, L.Nicolais, A.T.Dibenedetto (Inst. of Materials Sci., Univ. of Connecticut, Storrs, CT, USA).
J. Mater. Sci. (GB), vol.18, no.5, p.1466-72 (May 1983).
A variable radius of curvature strain bending apparatus has been used to investigate the propagation of surface crazes in polycarbonate exposed to a series of normal hydrocarbons from *n*-hexane to *n*-dodecane. In all cases it was found that for crazes growing in a zone free of other crazes, the growth rate was linear at constant temperature, and exponentially dependent upon temperature. An activated-state theory was developed to describe the kinetics of growth in terms of two parameters, B, a dimensionless strain constant which was independent of both the test variables and the crazing agent used, and A′ a characteristic growth rate parameter that varied exponentially with temperature where $A'=G_0 \exp-\Delta E_G/RT$. The rate constant G_0 and the activation energy ΔE_G correlate with the square of the difference between the solubility parameters of the crazing agent and polycarbonate. (11 refs.)

73238 Development of porous antireflective films on borosilicate glasses. A.Iqbal, S.C.Danforth, J.S.Haggerty (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.302-7 (April 1983).
Experiments were conducted to characterize the development of gradient-index antireflective (GIAR) films formed on a phase-separated alkali borosilicate glass. Solution chemistry, secondary-ion mass spectrometry, Auger electron spectroscopy, weight-loss, scanning electron microscopy, and specific surface area analyses were used to evaluate a proposed model for film formation. The results suggest that the film-forming process is more complicated than proposed. For near-optimum heat treatments, the film-formation acid treatment was virtually nonselective; only for much longer than optimum annealing times was selectivity evident. The graded-index films may result from precipitation of dissolved glass. The analyses were complicated by major compositional variations existing in the as-received glass. (19 refs.)

73239 Oxidation of $Hg_{1-x}Cd_xTe$ studied with surface sensitive techniques. P.Morgen, J.A.Silberman, I.Lindau, W.E.Spicer, J.A.Wilson (Dept. of Electrical Engng., Stanford Univ., Stanford, CA, USA).
J. Electron. Mater. (USA), vol.11, no.4, p.597-610 (July 1982). [received: Nov. 1982]
Reports the use of surface sensitive electron spectroscopies to monitor the initial steps of formation of a native oxide on atomically clean cleaved $Hg_{1-x}Cd_xTe$ single crystal surfaces in ultrahigh vacuum (UHV). Here the oxide is formed by oxygen excited by the presence of an operating ion gauge. During the reaction, the composition of the surface region of the substrate was found to change, with a net loss of Hg from the surface. Parallel studies of the compositions of thick anodic oxides using sputter profiling techniques showed only small amounts of Hg in the anodic oxides. (20 refs.)

73240 Thermal oxidation of silicon in the presence of iodine vapor and the properties of iodine oxide layers. V.P.Lebedev, E.E.Pakhomov.
Latv. PSR Zinat. Akad. Vestis Fiz. Teh. Zinat. Ser. (USSR), no.1, p.62-5 (1983). In Russian.
Deals with the substitution of a chlorine-containing component by iodine during the thermal oxidation of silicon with the aim of improving physicochemical and electrophysical parameters of Si-SiO_2. The obtained SiO_2 layers have the density of pores less than 10^2 cm^{-2} for 100 Å oxides. (3 refs.)

73241 Ion etching and its applicability in medicine. Z.W.Kowalski (Inst. Technol. Elektronowej, Politech. Wroclawskiej, Wroclaw, Poland).
Pr. Nauk. Inst. Technol. Elektron. Politech. Wroclaw. Ser. Monogr. (Poland), no.9, p.1-26 (1982). In Polish.
Basic physical effects accompanying ion etching of solids are described. The models of etching of amorphous and crystalline materials are discussed. The changes in the surface topography of solids due to ion etching as well as the possibilities of this process in revealing the structure of materials and modification of their surface are described. The applications of ion etching in medicine are presented, particular attention being given to cytological analyses and modifications of the implant surfaces. (73 refs.)

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management .... See Entry 69789

Laser processing and analysis of materials .... See Entry 69807

Differential reflectometry and its application to the study of alloys, ordering, corrosion, and surface properties .... See Entry 70108

The development and evaluation of SYNROC for high-level radioactive waste immobilization .... See Entry 70681

Evaluation of ceramic materials to immobilize ICPP calcines .... See Entry 70699

Development of sphene-based glass ceramics tailored for Canadian waste disposal conditions .... See Entry 70700

The leaching behaviour of the Swedish KBS-glasses ABS 39 and ABS 41 .... See Entry 70701

Metastable BCC phase in sputtered Fe-Ni alloys .... See Entry 72276

Preparation and properties of SmB_6 and SmB_4 single crystals .... See Entry 72980

Densification, thermal diffusion and Na vapor resistance of Y_2O_3 ceramics .... See Entry 73038

Hot pressing and properties of different Si_3N_4 qualities .... See Entry 73051

Bending strength of silicon nitride at 1250°C under static and cyclic bending load .... See Entry 73130

Effect of oxidizing environment on the strength of H451, PGX and IG-11 graphites .... See Entry 73167

Predictive calculations of volatilities of metals and oxides in steam-containing environments .... See Entry 73267

Diffusion-controlled reaction of water with glass .... See Entry 73329

81.60B Metals and alloys

(inc. stress corrosion cracking; anticorrosion)

73242 **Behaviour of the soft martensitic steel X5 CrNiMo 16 5 containing 2% Mo under corrosion fatigue in aqueous NaCl solutions up to 150°C.** K.G.Schmitt-Thomas, R.Mathis, H.Meisel (Lehrstuhls fur Metall. und Metallkunde, Tech. Univ. Munchen, Munchen, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.3, p.117-22 (March 1983). In German.
The corrosion fatigue behaviour of steel X5 CrNiMo 16 5 containing 2% Mo in aqueous NaCl solutions of different concentration is observed at 20, 80 and 150°C. The corrosion fatigue values are compared with each other and with the behaviour in air, interpretation is made of the experimental results by determination of the general corrosion behaviour and by macro- and microfractographical fracture and crack path assessment. The influence of nonmetallic inclusions on the corrosion fatigue behaviour is discussed. (22 refs.)

73243 **XPS study for the oxidation and the induced segregation at the surface of stainless steels.** A.Mosser, P.Humbert (Univ. Louis Pasteur, Strasbourg, France).
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.260-70 (March 1983). In French.
Interaction of oxygen with two austenitic stainless steel surfaces was investigated by XPS in the low pressure range and at different temperatures. Subsequent vacuum annealings at increasing temperatures were studied too. Similar results are obtained for both samples; they show that the composition of thegrown oxide layer depends on the oxidation temperature. The surface can either be enriched in oxidized iron at 300°C, or in oxidized chromium at 700°C, or in oxidized silicon at 900°C. During vacuum annealings, the less stable oxygen compounds are first reduced and released oxygen forms, with the other elements, the oxides which are still stable at the considered temperature. This phenomenon is accompanied by surface enrichment in these elements. (19 refs.)

73244 **AES studies of the oxides formed on iron-chromium alloys at 400°C.** S.C.Tjong (Dept. of Chem., Case Western Reserve Univ., Cleveland, OH, USA), J.Eldridge, R.W.Hoffman.
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.297-306 (March 1983).
Auger Electron Spectroscopy (AES) has been used to study the compositions and properties of the oxides formed at 400°C on Fe-Cr alloys. The alloys investigated consisted of Cr additions of 3%, 9%, 12% and 18%. It is found that for the Cr additions (Cr=3%), the oxide consists mainly of iron. However, the addition of Cr from 9% up to 18% results in the formation of layered oxides, i.e. Fe_2O_3 exists in the outer oxide/gas interface and $Fe_{3-x}Cr_xO_4$ in the inner region with the predominant chromium oxide next to the substrate. The additions of $Cr \geq 9\%$ to the alloys retard the oxide growth significantly. (16 refs.)

73245 **The mechanism of oxidation of Fe-Ni-Co alloys; the role of Ti and Mo.** I.E.Klein, A.E.Yaniv, J.Sharon (Armament Dev. Authority, Ministry of Defence, Haifa, Israel).
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.351-8 (March 1983).
Specimens of pure Ti and Mo, as well as 250 grade maraging steel, were heat treated in superheated steam at 485°C for 3h. The composition profiles and binding energies were studied, using AES and ESCA techniques. It has been shown that the mechanism of oxide formation is that of caution migration. (11 refs.)

73246 **Study of the superficial sulphurization of brass films supported on steel in relation to metal-rubber adhesion.** J.B.Pelletier, S.Toesca, J.C.Colson (Lab. de Recherches sur la Reactivite des Solides, Dijon, France).
Appl. Surf. Sci. (Netherlands), vol.14, no.3-4, p.375-81 (March 1983). In French.
The growth of thin layers of sulfides on brass plated steel foils has been investigated in relation to metal rubber adhesion. The diffusion profiles of the elements after reaction with hydrogen sulfide have been determined by glow discharge spectrometry, they exhibit initial formation of β-ZnS and subsequent growth of $Cu_{2-x}S$ and CuS when there is no addition element in brass. If a superficial deposit of nickel or cobalt has been achieved on the brass layer, the segregation of the metallic ions is inverted and the additional metal has a diffusion barrier behavior. (11 refs.)

73247 **Modelling approach to corrosion prediction.** C.Edeleanu (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England), J.G.Hines.
Br. Corros. J. (GB), vol.18, no.1, p.6-9 (1983).
The causes of, and penalties arising from, the inability to use our present knowledge to predict corrosion behaviour are outlined. A kinetic model of corrosion is proposed as one method of improving our predictive capabilities and the underlying philosophy is discussed. (5 refs.)

73248 **Analysis of complex polarisation curves [corrosion].** J.G.Hines (Engng. Dept., ICI plc, Winnington, England).
Br. Corros. J. (GB), vol.18, no.1, p.10-14 (1983).
It has long been recognised that analysis of polarisation curves can provide valuable insight into the mechanisms of electrochemical processes provided that the analysis is founded on theoretically based equations such that the coefficients have physical meaning. This approach has however been confined to relatively simple cases where only one or possibly two reactions are involved. An approach has now been developed which permits quantitative analysis of more complex polarisation curves in terms of theoretically based models. The approach is illustrated using the case of stainless steels in acid solutions, but is applicable to other cases. (3 refs.)

73249 **Validification of a computer analysis of potentiodynamic curves [corrosion].** J.H.Cleland, C.Edeleanu (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
Br. Corros. J. (GB), vol.18, no.1, p.15-18 (1983).
Prediction of corrosion behaviour from the potentiodynamic polarisation curve is limited by the difficulties met in its quantitative interpretation. To overcome this the potentiodynamic polarisation curve has been modelled and a program called LOOPFIT has been written which can numerically analyse the potentiodynamic polarisation curve. The authors describe the experimental validification of LOOPFIT. (3 refs.)

73250 **Inhibition of iron corrosion in different acid media by N-decylpyridinium derivatives.** A.Frignani (Corrosion Study Centre 'Aldo Dacco', Univ. of Ferrara, Ferrara, Italy), F.Zucchi, C.Monticelli.
Br. Corros. J. (GB), vol.18, no.1, p.19-24 (1983).
Some derivatives of the n-decyl-pyridinium ion (DP) have been tested as iron corrosion inhibitors in sulphuric and hydrochloric acid solutions at 25°C and 70°C. These inhibitors were tested both as bromides and as hydroxides or sulphates. The efficiency of the DP ion can be improved by the introduction of suitable substituents in the 3-position of the aromatic ring. In all the acid solutions tested, the most efficient ion at 25° proved to be the n-decyl-3-hydroxy-pyridinium (D3OP) ion, while at 70°C, the n-decyl-3-carboxypyridinium (D3CP) ion was the most efficient. These derivatives act mainly by physical adsorption between the organic cations and the anions (Cl^- or Br^-) pre-adsorbed at the metal surface of the electrode. But in order to explain all the experimental data other types of interactions have to be considered, such as: Van der Waals attractive forces between the aliphatic chains, interaction of π electrons with the metal surface, and adsorption on to the metal surface. The organic cations studied inhibit mainly the H^+ ion discharge, but when present in higher concentrations they also inhibit the iron dissolution reaction. (38 refs.)

73251 **Corrosion and stress corrosion of arc welds in 18% chromium-2% molybdenum-titanium stabilised stainless steel.** J.Honeycomb, T.G.Gooch (Welding Inst., Cambridge, England).
Br. Corros. J. (GB), vol.18, no.1, p.25-34 (1983).
A study has been made of the effect of welding on the corrosion properties of 18%Cr-2%Mo-titanium stabilised ferritic stainless steel sheet from 2 to 3.5 nm thickness and 9 mm plate. Intercrystalline, pitting and crevice corrosion resistance of welds was evaluated, using immersion and potentiostatic techniques, with stress corrosion behaviour being assessed using transverse weld tensile samples in $MgCl_2$ and $CaCl_2$ solutions. Welding promoted some susceptibility to intercrystalline attack, although all welds passed the Strauss bend test criterion for sensitisation. Resistance to pitting and crevice corrosion in $FeCl_3$ was reduced by welding. No stress corrosion was observed in the parent material, but joints made with nonmatching composition consumables suffered cracking, although susceptibility was less than that associated with austenitic grades of steel. It is concluded that in most environmental situations the loss in corrosion resistance as a result of welding will not be significant. For the highest corrosion resistance, the use of matching composition consumables is preferred. (38 refs.)

73252 **Effect of temperature on the corrosion of 70/30 copper-nickel in sea water.** R.Francis (Grove Labs., BNF Metals Technol., Wantage, England).
Br. Corros. J. (GB), vol.18, no.1, p.35-9 (1983).
Presents the results of experiments to investigate the effect of temperature on the films found on 70/30 copper-nickel. The results show that the potential of 70/30 copper-nickel and 66/30/2/2 copper-nickel explain the poor resistance to impingement attack of this alloy at low temperatures, observed greater than 10°C. At temperatures below 10°C the potential remained more or less constant at about −200 mV (SCE) for the duration of the test. The electropositive shift in potential was associated with an enrichment of iron in the film on the 70/30 copper-nickel alloy. No clear changes in film composition with temperature could be determined for the 66/30/2/2 copper-nickel-iron-manganese alloy. No changes in potential were observed for 90/10 copper-nickel, even after extended testing. (10 refs.)

73253 **Effect of pH on the stress corrosion cracking of α-brass in chlorate solution.** V.K.Gouda (Nat. Res. Centre, Cairo, Egypt), H.A.El-Sayed, G.M.Sherbini.
Br. Corros. J. (GB), vol.18, no.1, p.40-6 (1983).
The stress corrosion cracking (SCC) behaviour of 72/28 brass has been studied in sodium chlorate solutions at ambient temperature over a pH range of 2 to 12, at the open-circuit potential and at controlled potentials, using the slow strain rate technique. A constant strain rate of 1.5×10^{-5} s^{-1} was applied. Under free corrosion conditions, stress corrosion cracking was observed for the specimens tested in the pH range 4-9. Application of cathodic potentials prevented SCC, while application of anodic potentials accelerated SCC in the whole range of pH studied. It was observed that the severity of cracking increased with increase of potential, which was in the range, +200 to +400 mV_H. It was also noticed that, at a fixed applied potential, the SCC severity increased with an increase in pH in the range of pH 2-6, stayed relatively constant up to pH 8 and decreased thereafter. Metallographic inspection revealed that, under open-circuit potential and up to a potential value of $\simeq 200$ mV_H, the mode of cracking was predominantly intergranular, while at potentials >200 mV_H transgranular cracking predominated. The results support the anodic dissolution mechanism of SCC. (24 refs.)

73254 **Evaporation instability and surface oxidation of a solid under irradiation.** M.I.Tribel'skii.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.102-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1127-34 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
A survey is presented of the state of the subject as regards instability resulting in deviation from the initial symmetry when a high-power optical beam interacts with a material. Laser sublimation and thermochemical instability are considered in relation to the growth of the oxide film on a metal heated by a laser beam. (11 refs.)

73255 The relationship of oxide film thickness and composition on titanium to the absorption coefficient on laser irradiation in an oxidizing atmosphere. A.G.Akimov, A.M.Bonch-Bruevich, A.P.Gagarin, V.G.Dorofeev, P.A.Zimin, I.N.Ivanova, M.N.Libenson, V.S.Makin, S.D.Pudkov.

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.145-51 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1177-85 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).

Studies have been made on the growth kinetics, structure, and optical parameters of oxide films formed on heating titanium in air, by laser beam. It is found that the film thickness determined by optical methods is substantially less than the total depth to which oxygen penetrates into the titanium. Reflection spectra of clean and oxidized titanium specimens have been derived and interpreted; there are marked differences in the kinetics of isothermal and laser oxidation processes. (12 refs.)

73256 An ESCA and Mossbauer study of the oxide layer formed on steel in water containing chromate and chloride ions. W.Meisel, E.Mohs, H.-J.Guttman, P.Gutlich (Inst. fur Anorganische und Analytische Chem., Johannes Gutenberg-Univ., Mainz, Germany).

Corros. Sci. (GB), vol.23, no.5, p.465-71 (1983).

The formation of oxidic layers of steel in chromate solutions was studied by photoelectron and Mossbauer spectroscopy. To simulate more aggressive realistic systems, some chloride ions were added to the solution. The layers formed under these conditions were found to be thicker by an order of magnitude than those formed in the absence of chloride ions. They probably consist of ferric and chromic oxides of the corundum type $(Fe_{1-x}Cr_x)_2O_3$, with the Cr:Fe ratio being depth dependent. The oxide layer is subdivided into small regions behaving superparamagnetically. This heterogeneity of the layer is ascribed to the attack by the chloride ions. The structure of the oxides found differs from the spinel structure reported by other authors who used chloride-free solutions. (22 refs.)

73257 The corrosion inhibition of iron by amines and fatty acids in neutral media. T.Szauer, A.Brandt (Inst. of Inorganic Chem. & Technol., Tech. Univ. of Gdansk, Gdansk, Poland).

Corros. Sci. (GB), vol.23, no.5, p.473-80 (1983).

The inhibitive properties of amine-18C fatty acid salts against the corrosion of iron in 0.5 M Na_2SO_4 have been evaluated. Potentiostatic polarization and resistance measurements in conjunction with corrosion rate determination indicated a substantial difference between the mechanism and efficiency of action of these compounds in neutral and acidic media. On the ground of previous findings the inferior inhibition in neutral media was linked to the tendency of amines and fatty acids to form complexes which did not lead to such effective surface layers as in acidic solutions. (14 refs.)

73258 The corrosion inhibition of iron by amines and fatty acids placed in protective coatings. T.Szauer (Inst. of Inorganic Chem. & Technol., Tech. Univ. of Gdansk, Gdansk, Poland).

Corros. Sci. (GB), vol.23, no.5, p.481-94 (1983).

It has been found that salts of amines and 18C unsaturated acids act in a different manner as corrosion inhibitors in organic coatings, depending on the reaction of the corrosion environment. The salts showed outstanding inhibition activity in the case of the acidic environment. Comparably high inhibitive effects were obtained with these compounds through acidification of the coating material, followed by exposure to a neutral solution. It has also been found that the mode of protection by inhibited coatings can be identified by determining the impedance of coated electrodes as a function of the frequency of the low voltage measuring signal. (42 refs.)

73259 The role of oxide grain boundaries in the development of growth stresses during oxidation. H.E.Evans (Berkeley Nuclear Labs., CEGB, Berkeley, England).

Corros. Sci. (GB), vol.23, no.5, p.495-506 (1983).

A model is described which identifies the oxide growth stresses observed in many systems with the diffusion of anions along oxide grain boundaries and the subsequent formation of an oxide intrusion at the oxide/metal interface. Detailed calculations are made of the elastic stress system within the metal and of the average stress developed in the oxide. For a Pilling-Bedworth ratio greater than unity, the oxide intrusion acts as a linear centre of dilatation generating short-range tensile stresses within the metal and equivalent compressive stresses within the oxide. It is shown that the average value of the oxide stress increases with both the oxide grain size and with the lateral dimensions of the oxide intrusion. (27 refs.)

73260 The corrosion behaviour of AISI 304L stainless steel in 0.1 M HCl at room temperature. I. G.Salvago, G.Fumagalli, D.Sinigaglia (Dept. of Appl. Phys. Chem., Milano Polytech., Milano, Italy).

Corros. Sci. (GB), vol.23, no.5, p.507-14 (1983).

A consideration of the critical potential and the protection potential of localized corrosion is given. From a hypothesis about when a fully developed localized attack can occur a definition of the field of protection potential has been attempted. The potentiostatic method was used to define this field relative to solution heat treated AISI 304L stainless steel in 0.1 M HCl at 20°C, with test times of $\geq$150 h. The results obtained differ significantly from what can be deduced from the potentiodynamic technique, and they confirm the formulated hypothesis and definitions. In the active loop of potentiodynamic curves, the nucleation and development of pitting, together with general corrosion, is documented by SEM. The hypothesis can be advanced that such pitting corrosion is a direct consequence of inhibition phenomena resulting from products formed during overall corrosion. (27 refs.)

73261 The corrosion behavior of AISI 304L stainless steel in 0.1 M HCl at room temperature. II. The effect of cold working. G.Salvago, G.Fumagalli, D.Sinigaglia (Dept. of Appl. Phys. Chem., Milano Polytech., Milano, Italy).

Corros. Sci. (GB), vol.23, no.5, p.515-23 (1983).

For pt.I see ibid., vol.23, no.5, p.507-14 (1983). Describes the results of a study concerning the influence of cold working upon the corrosion behaviour of an AISI 304L in HCl 0.1 M at room temperature. Potentiostatic tests, with test times of $\geq$150 h, followed by SEM observations, revealed that even though cold working lowers the critical pitting potential, it does not impair the susceptibility to localized corrosion. Evidence is provided for (1) pitting activity below the primary passivation potential, and (2) preferential attack on either the austenitic matrix or the martensitic phase, depending upon the corrosion potential below the protection field. It can be hypothesized that the above-mentioned behaviour is a consequence of the formation of corrosion products favoured by the presence of two metallic phases. Such products have inhibiting properties which determine pitting corrosion below the primary passivation potential and, in addition, they hinder the formation of passivity films and facilitate their local destruction. (5 refs.)

73262 Anomalous corrosion of hydrogen-containing ferritic steels in aqueous acid solution. M.Hasegawa (Dept. of Metall. Engng., Waseda Univ., Tokyo, Japan), M.Osawa.

Corrosion (USA), vol.39, no.4, p.115-20 (April 1983).

The effect of dissolved hydrogen in soft iron and ferritic low alloy steel on general corrosion was investigated in acid solutions. Hydrogen charging was carried out in 1 to 28 MPa hydrogen at 723K for 57.6 ks. Weight loss of hydrogen charged ferritic steels was markedly greater than that of hydrogen-free ones, and increased with increasing hydrogen content. Plastic deformation of steels increased the dissolved hydrogen content, and the anomalous corrosion increased with cold working ratio. Anodic polarisation curves of hydrogen charged soft iron and low alloy steel in 0.5 $kmol/m^3$-H_2SO_4 solution exhibited an increase of current density in the passive region in agreement with the corrosion data. This anomalous corrosion was partly recovered by dehydrogenation heating at 573 to 1223K. The anomalous corrosion was dependent on the residual hydrogen content and independent of the structure. It is suggested that the anomalous behavior is caused by activated internal microdefects in steel formed by hydrogen trapping. (16 refs.)

73263 Stress corrosion cracking characterization of 3.5 NiCrMoV low pressure turbine rotor steels in NaOH and NaCl solutions. F.F.Lyle,Jr. (Dept. of Materials Sci., Southwest Res. Inst., San Antonio, TX, USA).

Corrosion (USA), vol.39, no.4, p.120-31 (April 1983).

Describes a research program conducted to determine susceptibility of steels used in low pressure (KLLP) turbine rotors of power plants to stress corrosion cracking (SCC) in LP turbine environments. Slow strain rate SCC tests were conducted on samples from two 3.5 NiCrMoV rotor forgings over a temperature range of 38 to 204 C (100 to 400 F). Environments employed included pure NaOH solutions, 3.5% NaCl, pure water, and mixtures of NaOH and NaCl, Na_2S, Na_2SO_4, or CuO. Supplementary electrochemical data also were generated. Test results indicate that the minimum NaOH concentration required to produce detectable SCC decreases with increasing temperature. Addition of small amounts of NaCl reduced the concentration of NaOH necessary to produce SCC at 157°C (315°F). Pure 3.5% NaCl induced SCC at 121°C (250°F). SCC was not detected in either steel in tests in pure water at 157°C (315°F). (23 refs.)

73264 Sensitization of austenitic stainless steels. II. Commercial purity alloys. R.A.Mulford, E.L.Hall, C.L.Briant (General Electric. Co., Corporate Res. & Dev. Center, Schenectady, NY, USA).

Corrosion (USA), vol.39, no.4, p.132-43 (April 1983).

For pt.I see ibid., vol.38, no.9, p.468 (1982). Presents a study of the effects of nitrogen and molybdenum on the sensitization of commercial purity type 304 and 316 stainless steels. The modified Strauss test (ASTM-A262-E) is used to determine the degree of sensitization of the steels, and Auger spectroscopy and analytical electron microscopy are used to study the chemistry of grain boundaries and the crystallography and chemistry of grain boundary phases. The corrosion data from different alloys are considered in terms of effective chromium content. The corrosion behavior of commercial purity 304 and 316 alloys is found to be inferior to the corresponding high-purity alloys. The Auger data indicates that this is due to the segregation of phosphorus to the grain boundaries. Nitrogen has a beneficial effect on the behavior of type 304 stainless steel, but the improvement due to this element is generally on the behavior of type 304 stainless steel, but the improvement due to this element is generally less than in high-purity alloys. Molybdenum additions strongly improve the corrosion behavior by increasing the amount of chromium depletion necessary for sensitization. (33 refs.)

73265 The anodic dissolution of a Ni-base superalloy. M.A.Cavanaugh (Dept. of Chem. & Phys., Saint Mary's Coll., Notre Dame, IN, USA), J.A.Kargol, J.Nickerson, N.F.Fiore.

Corrosion (USA), vol.39, no.4, p.144-50 (April 1983).

A single phase nickel base superalloy, HASTELLOY Alloy C-276, was anodically polarized in 0.5 N NaCl at 70 C, and the concentrations of metal-ion complexes in solution were determined. Relative dissolution rates of alloying elements were obtained and selectivity coefficients were calculated. The corrosion products that formed at high anodic potentials were identified as $FeCl^{2+}$, Ni^{2+}, $HCrO_4^-$, and MoO_4^{2-}. The pH was observed to decrease and the chloride ion concentration to increase in the electrolyte when diffusion of corrosion products out from an occluded region at the alloy surface was restricted. The increased hydrogen ion concentration in the occluded region was explained by the formation of molybdate and chromate ions as corrosion products. The high corrosion resistance of Alloy C-276 in chloride may be related to the formation of corrosion-inhibiting molybdate ion. (32 refs.)

73266 Electrochemical etching of copper ion implanted H-19 aluminum in aqueous chloride/sulfate solution at 95 C. S.M.Florio, W.M.Moore, G.A.Hutchins, S.E.Summers (Sprague Electric Co., North Adams, MA, USA).

Corrosion (USA), vol.39, no.4, p.151-8 (April 1983).

Electrochemical etching experiments were conducted with Cu ion implanted H-19 Al foil in aqueous $NaCl/Na_2SO_4$ solution at 95°C in an effort to improve the procedure for the surface area enhancement of Al. The concentration of Cu in unimplanted and implanted specimens was determined by electron probe microanalysis. An amorphous passive film on the order of 200 Å thick formed on the Al surface in the 95°C etch solution prior to the electrochemical etch. A model for the etch process in which pits were seen to propagate immediately at flaws in this passive surface was supported by the shape and distribution of etch pits after brief etching. Pits propagated under the surface oxide in crystallographically determined directions in both unimplanted and Cu implanted samples. The presence of ion implanted Cu resulted in a smaller number of more highly developed, deeper pits. Capacitance versus voltage and weight loss measurements of highly etched samples indicated that approximately the same amount of overall Al dissolution occurred in all samples. (27 refs.)

73267 Predictive calculations of volatilities of metals and oxides in steam-containing environments. O.H.Krikorian (Lawrence Livermore Nat. Lab., Livermore, CA, USA).

High Temp.-High Pressures (GB), vol.14, no.4, p.387-97 (1982)., Harwell, Oxon., England, 7-10 Sept. 1981).

Steam-accelerated corrosion of metal alloys and ceramics, and steam volatilization of oxides in general, is a serious problem in a number of energy applications, especially in attempts to extend the conditions for use of materials. Predictive methods are developed here for estimating the bond energies and free energy functions of volatile species having the general formula $MO_x(OH)_y$, in order to extend knowledge of the mechanisms and extent of steam-accelerated volatilization processes. A specific application of the data is illustrated for the case of a proposed process for underground disposal of radioactive waste, where oxides of radionuclides are allowed to equilibrate with 100 atm steam and 10^{-2} atm oxygen at 1000-2000K. Vapor species found to have high volatilities include $Cs_2(OH)_2$, $CsOH$, $AmO_2(OH)_2$, $AmO(OH)_3$, $UO_2(OH)_2$, $NbO(OH)_3$, $PuO_2(OH)_2$, $CeO(OH)_2$, $Ba(OH)_2$, and

$Eu(OH)_3$. Thermodynamic data are tabulated for all possible monomeric species for this specific example. (34 refs.)

73268 Corrosion study of a carbon steel in neutral chloride solutions by impedance techniques. A.Bonnel, F.Dabosi (Lab. de Metall. Phys., Ecole Nat. Superieure de Chimie, Toulouse, France), C.Deslouis, M.Duprat, M.Keddam, B.Tribollet.
J. Electrochem. Soc. (USA), vol.130, no.4, p.753-61 (April 1983).
The electrochemical behavior of a carbon steel in 3% NaCl solution has been investigated using a rotating disk electrode. Both steady-state (diffusional current vs. the disk angular velocity plots) and transient (frequency analysis of the electrohydrodynamical impedance) measurements which specifically sample mass transport phenomena, have been carried out. Oxygen transport takes place not only in the liquid phase but also through a porous layer of corrosion products. From electrochemical impedance measurements, it was found that the corrosion potential the oxygen reduction reaction is under either diffusional or mixed (activation+diffusion) control depending on both the electrode rotation speed and on the hold time at the free corrosion potential. In addition, it was shown that the oxygen consumption occurs not only by electrochemical reduction but also by chemical oxidation of ferrous to ferric ions. Finally, because of the possible occurrence of mixed corrosion control, it is emphasized that the use of the polarization resistance in order to evaluate corrosion rates is not always valid. (16 refs.)

73269 Corrosion inhibition study of a carbon steel in neutral chloride solutions by impedance techniques. F.Dabosi (Lab. de Metall. Phys., Ecole Nat. Superieure de Chimie, Toulouse, France), C.Deslouis, M.Duprat, M.Keddam.
J. Electrochem. Soc. (USA), vol.130, no.4, p.761-6 (April 1983).
The electrochemical behaviour of a carbon steel in 3% NaCl solution containing 10^{-2}M of diamino-1,2-ethane has been investigated using a rotating disk electrode. Both steady-state (current-voltage curves for various disk rotation speeds) and transient (frequency analysis of the electrohydrodynamical and electrochemical impedances) measurements have been carried out. It was concluded that the oxygen reduction process at the corrosion potential was mainly controlled by charge transfer which is at variance with the uninhibited situation. Consequently, polarization resistance measurements can be used in this case to estimate corrosion rates. Regarding the mode of inhibition of diamino-1,2-ethane, the data are consistent with the chelation mechanism proposed for this type of bifunctional compound; it appears that the inhibitive action mainly affects the anodic reaction. (4 refs.)

73270 Observation of nickel inclusions in thermally grown NiO scales. D.Quinn, G.L.Leatherman, R.K.MacCrone, S.R.Shatynski (Dept. of Materials Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.907-12 (April 1983).
Films of NiO thermally grown at 900°C in various oxygen pressures were examined using magnetic resonance techniques. The NiO films were grown in Ar-O_2 gas mixtures which varied from 0.1 to 1 atm oxygen pressure. Samples were then removed from the nickel substrate and examined using magnetic resonance. These experiments detected discrete cigar or pancake particles of metallic nickel embedded in the NiO scale. Careful examination of these films using optical microscopy also revealed the presence of nickel particles in the NiO external scale. From these results, a model for the oxidation of nickel based upon grain boundary oxidation was developed which incorporates the formation of metallic nickel inclusions in NiO scale. Such results add further insight into the mechanism of oxidation of nickel and reveal further deviation from simple bulk diffusion growth models. (36 refs.)

73271 The cohesive and adhesive strength of ice [on metal substrates]. E.H.Andrews, N.A.Lockington (Dept. of Materials, Queen Mary Coll., London, England).
J. Mater. Sci. (GB), vol.18, no.5, p.1455-65 (May 1983).
The plane-strain fracture-energy test developed by Andrews and Stevenson has been applied to the study of ice adhering to substrates of stainless steel, titanium and anodised aluminium. In most cases the fracture is cohesive through the ice, and therefore yields a cohesive fracture energy (critical energy release rate). The value of this fracture energy, however, is dependent upon the nature of the substrate, stainless steel giving significantly lower values than titanium. The fracture energy is also affected by the rate of formation of the ice and by the rate of testing. Many of these effects can be traced to the influence of the substrate on the air-bubble content of the ice layer. At testing temperatures approaching the melting point of ice, a transition in fracture mode is observed from cohesive to adhesive, and the fracture energy diminishes. The addition of small amounts of sodium fluoride to the water from which the ice is formed, lowers the transition temperature to −5°C, and emphasizes the transition to the adhesive failure mode. (24 refs.)

73272 Surface melting of a medium carbon steel by laser treatment. M.Carbucicchio, G.Meazza (Inst. of Phys., Univ. of Parma, Parma, Italy), G.Palombarini, G.Sambogna.
J. Mater. Sci. (GB), vol.18, no.5, p.1543-8 (May 1983).
A 0.4 wt.%C normalized carbon steel has been graphite-coated and irradiated in air with a cw-CO_2 laser beam at 1.3 kJ cm^{-2} to melt a near-surface layer of material. The solidified and the solid-state transformed regions have been investigated by means of surface Mossbauer spectroscopy, X-ray diffraction, metallography and microhardness measurements. Nature and morphology of the phases have been determined in each region, and their origin discussed in relation to the conditions of the treatment. (13 refs.)

73273 A molecular mechanism for stress corrosion in vitreous silica. T.A.Michalske, S.W.Freiman (Ceramic Dev., Sandia Labs., Albuquerque, NM, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.284-8 (April 1983).
The mechanical strength of most glasses and ceramics decreases with time under static loading in an ambient environment. This strength loss is associated with slow growth of preexisting surface flaws due to stress corrosion by water from the surrounding environment. The authors studied stress corrosion in vitreous silica exposed to water and several nonaqueous environments; environments which enhance stress-corrosion crack growth in silica contain active groups with electron donor sites on one end and proton donor sites at the other. These results suggest a detailed chemical model for the interaction of the environment with mechanically strained bonds in the solid at the tip of a crack. The proposed model for stress-corrosion crack growth also has implications for the long-term strength behavior of a wide variety of brittle materials. (16 refs.)

73274 Crevice corrosion of Ti-0.2% Pd alloy and pure Ti. Sung Tae Ahn, Kwang Bum Kim, Young Ku Yoon (Div. of Materials Sci. & Metall. Engng., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
J. Korean Inst. Met., vol.21, no.1, p.25-8 (Jan. 1983). In Korean.
Crevice corrosion properties of Ti-0.2 wt.% Pd alloy and pure Ti in hot 6% NaCl solution were investigated. Pure Ti specimens exhibited severe corrosion, while Ti-0.2% Pd alloy specimens were virtually immune to crevice corrosion in an accelerated test. An electrochemical polarization technique was used to determine the effect of Pd-addition to Ti. It was found that Ti-0.2% Pd alloy retained passivity in an acid solution of the same concentration developed in the crevice. This result indicates that Pd acts as a cathodic depolarizer to shift the potential of Ti in the noble direction. It is therefore concluded that small addition, namely 0.2% of Pd, effectively improves the resistance of Ti to crevice corrosion in a hot brine. (6 refs.)

73275 A fundamental study of laser transformation hardening. S.Kou, D.K.Sun, Y.P.Le (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Metall. Trans. A (USA), vol.14A, no.4, p.643-53 (April 1983).
A theoretical and experimental study of heat flow and solid-state phase transformations during the laser surface hardening of 1018 steel was conducted. A three-dimensional heat flow model was developed using the finite difference method. The surface heat loss, the temperature dependence of the surface absorptivity, and the temperature dependence of thermal properties were considered. This heat flow model was verified with the analytical solution of Jaeger and was used to provide general heat flow information, based on the assumptions of no surface heat loss, constant surface absorptivity, and constant thermal properties. A continuous-wave CO_2 laser of 15 kW capacity was used in conjunction with a beam integrator to surface harden 1018 steel plates. The beam power and the travel speed of the workpiece were varied, and the onset of surface melting was determined. The configurations of the heat-affected zone observed were compared with those calculated using the heat flow model. The microstructure of the heat-affected zone was explained with the help of the calculated peak temperature, heating, and cooling rates. (27 refs.)

73276 Crack tip oxidation of a superalloy in molten nitrate salt. S.H.Goods (Sandia Nat. Labs., Livermore, CA, USA).
Scr. Metall. (USA), vol.17, no.4, p.533-6 (April 1983).
Examines the influence of a typical nitrate salt composition on crack tip oxidation in Alloy 800 in order to determine if in fact the proposed corrosion phenomena could explain the fatigue crack growth characteristics of the alloy. (5 refs.)

73277 Some considerations on the modelling of oxide-induced fatigue crack closure using solutions for a rigid wedge inside a linear elastic crack. S.Suresh, R.O.Ritchie (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Scr. Metall. (USA), vol.17, no.4, p.575-80 (April 1983).
The significance and limitations of the simple model of a rigid wedge inside a linear elastic crack, used to estimate closure stress intensities resulting from the formation of corrosion deposits during corrosion fatigue, are described. The resultant closure stress intensities predicted by the model are shown to be a strong function of the wedge thickness and its location directly behind the crack tip. Although the wedge thickness can be experimentally estimated by computing the excess oxide thickness from Auger and Secondary Ion Mass Spectroscopy measurements, the oxide film profile in the immediate vicinity of the crack tip is difficult to resolve. Since this near-tip oxide distribution is critical in the estimation of the wedge force, more rigorous calculations of the extent of oxide-induced crack closure are not feasible. (21 refs.)

73278 Formation of the contact zone between a detonation-deposited coating and a basis material. Yu.A.Kharlamov (Voroshilovgrad Machine Construction Inst., USSR).
Sov. Powder Metall. & Met. Ceram. (USA), vol.21, no.9, p.709-11 (Sept. 1982). Translation of: *Poroshk. Metall. (USSR)*, vol.21, no.9, p.31-5 (Sept. 1982). [received: March 1983]
Possible mechanisms of mass transport during the formation of detonation-deposited coatings are examined. The starting materials were standard mechanical mixtures of VK8 (WC+8% Co) powder of particle size not more than 1-2 μm, a mechanical mixture of KKhN-30 (Cr_3C_2-30% Ni) and VSNGN-85 powders of particle size not more than 50 μm, and a copper powder (20-50 μm). (6 refs.)

73279 Pretreatment of galvanized surfaces prior to powder coating. R.D.E.L.Bridger (Waterisation UK Ltd., Croydon, England).
Trans. Inst. Met. Finish. (GB), vol.61, pt.1, p.13-18 (Spring 1983).
Covers the various methods and processes suitable for the pretreatment of galvanized steel surfaces prior to the application of powder coatings, drawing upon results from industrial coating installations as well as those from laboratory testing. It is important to differentiate between the types of zinc coated surfaces and in particular between strip-line galvanized steel sheet and heavy conventional hot dip galvanized steel. The main precleaning processes in use are alkali cleaning/etching and acid etching, the choice being influenced by the method of application and the thickness of the overlying zinc layer. Conversion coatings are necessary to ensure adequate service life and here the choice lies between chromating and phosphating. Accelerated corrosion tests have indicated that certain yellow chromate processes are to be preferred for the treatment of thick galvanized surfaces, whereas chromate, chromate/phosphate and micro-crystalline zinc phosphate processes may all be suitable for use on strip-line galvanized sheet. (no refs.)

73280 The effect of coating alloy composition on the quality of terneplate. S.J.Muckett, M.E.Warwick (Internat. Tin Res. Inst., Greenford, England).
Trans. Inst. Met. Finish. (GB), vol.61, pt.1, p.19-24 (Spring 1983).
The effect of coating alloy composition on the corrosion resistance and porosity of laboratory produced terneplate (cold rolled steel coated with a lead-rich alloy) is assessed. The results indicate that an increase in the tin content of a coating alloy is beneficial to coating quality whereas substitution of antimony for tin is detrimental to coating performance under test. The metallurgy of the bond between the steel substrate and alloy coating is considered, and the likely causes of pores occurring through the coating, which are the sites of subsequent corrosion, are reported. (18 refs.)

73281 The use of electron microscopy in studies of electrolytically coloured anodized aluminium. R.C.Furneaux (Alcan Internat. Ltd., Banbury, England).
Trans. Inst. Met. Finish. (GB), vol.61, pt.1, p.35-40 (Spring 1983).
Deficiencies in the current understanding of electrolytic colouring are identified and considered in terms of film microstructure. Electron optical methods suitable for microscopic study are described and it is indicated how each method has particular applications in elucidating mechanisms operative during colouring and explaining the properties of coloured finishes. Backscattered electron images obtained with the scanning electron microscope clearly reveal the deposit distribution in cross-section within the film. Major differences in distribution have been observed for different black finishes depending on the solution used for electrolytic colouring. Where deposits extend to or near the film surface, they act as preferential pathways for attack leading to premature failure during the acetic acid salt spray test. Transmission electron microscopy reveals the fine structural features of coloured films. Carbon replication and ultramicrotomy allow cross-sections to be studied in detail, while ion beam thinning produces plan sections suitable for examination. Different structures, depending on the relationship between the anodizing and electrolytic colouring voltage, have been observed after colouring in relatively acidic solutions compared with more neutral pH solutions. (20 refs.)

73282 In situ analysis of passive and transpassive films on nickel by modulated UV-visible reflection spectroscopy. N.Hara, K.Sugimoto (Dept. of Metall., Tohoku Univ., Sendai, Japan).
Trans. Jpn. Inst. Met. (Japan), vol.24, no.4, p.236-45 (April 1983).
Modulated reflection spectra have been measured on Ni at passive and transpassive potentials in 0.5 kmol.m^{-3} H_2SO_4 (pH 0.3), 1 kmol.m^{-3} Na_2SO_4 (pH 2.0-12.0), 0.1 kmol.m^{-3} NaOH (pH 13.1), in 1 kmol.m^{-3} NaOH (pH 13.7). By comparing the spectra with those of several reference Ni oxides and oxyhydroxides, constituent substances of passive and transpassive films formed on Ni in these solutions have been identified. It was found that the composition of the films changed remarkably with solution pH and electrode potential: In acid solutions of pH ≤ 4.0, the primary passive film was mainly composed of NiO, and the transpassive film of a nonstoichiometric NI(II) oxide, i.e. NiO_x. The value of x in NiO_x increased with increasing potential. The change in the film composition in neutral solutions having pH between 6.0 and 9.0 was very similar to that in acid solutions, except that a thin layer of λ-NiOOH-2NiO_2 was formed on the surface of NiO_x film. This occurred at transpassivation and oxygen evolution potentials through the anodic oxidation of dissolved Ni^{2+} ions. (38 refs.)

73283 Effect of environmental factors on the magnitude of polarization developed in eutectoid prestressing steels. R.Narayan (Dept. of Metall., Indian Inst. of Technol., Kanpur, India).
Trans. SAEST (India), vol.17, no.4, p.267-77 (Oct.-Dec. 1982). [received: May 1983]
Several service failures of prestressing steels have been attributed to the polarization effects of various concentration cells. The magnitude of such polarization for eutectoid steel in many heat treated conditions under a wide range of environments have been measured over extended periods. The degree of self polarization potentials that could develop under corrosive conditions likely to be met in practice are discussed. It has been estimated that differential oxygen concentration cells and differential stress cells could produce polarization up to 200 mV and 500 mV respectively. Differential chloride concentration could polarize eutectoid steel by 500 mV, whereas coupling with mild steel could polarize up to 700 mV. (4 refs.)

73284 A note on the effect of heat treatment on the magnesium alloy used as galvanic anode. K.Balakrishan, S.Venkatakrishna Iyer, R.Arghode, N.Palaniswamy (Central Electrochem. Res. Inst., Karaikud, India).
Trans. SAEST (India), vol.17, no.4, p.315-19 (Oct.-Dec. 1982). [received: May 1983]
The behaviour of a magnesium quaternary alloy patented in the Central Electrochemical Research Institute, has been examined after heat treatment in an atmosphere of CO_2. The performance of this alloy has been studied and evaluated in respect of self corrosion, anode efficiency and anodic polarisation in 0.01 and 3% sodium chloride solutions. In situ studies and photomicrographic studies have also been carried out, to understand the effect of heat treatment. These studies reveal the fact that while the heat treatment has no beneficial influence on the corrosion resistance of the alloy in 3% sodium chloride solution, it marginally improves the efficiency of the alloy in 0.01% NaCl solution. (13 refs.)

73285 Toluidines as corrosion inhibitors for aluminium-copper alloy in hydrochloric acid. R.B.Patel (Chem. Dept., Government Coll., Daman, India), J.M.Pandya, K.Lal.
Trans. SAEST (India), vol.17, no.4, p.321-4 (Oct.-Dec. 1982). [received: May 1983]
The corrosion of aluminium-copper and its inhibition in hydrochloric acid has been studied. The efficiency of the inhibitor (1.0%) increase as: p-toluidine$<$o-toluidine$<$m-toluidine in different concentrations (0.1N-0.3N) of HCl. The percentage inhibition decreases with increase in the concentration of the acid and time. The influence to current density on the cathodic and anodic polarization of B26S aluminium in 0.1N HCl containing 1.5% inhibitor was also studied. All three inhibitors appear to be effective as mixed inhibitors. (5 refs.)

73286 Parameters of strain-induced corrosion cracking in low alloy steels in a flow of high temperature water. E.Lenz, A.Liebert, B.Stellwag, N.Wieling (Kraftwerk Union AG, Erlangen, Germany).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.22/1-15 In German.
The crack corrosion mechanism of low alloy steels: 17 MnMoV64, 20MnMoNi55 and 15NiCuMoNb5 is explained and tests are described aiming at establishing the influence of water acidity and temperature, on cracking of fine-grain steels in a constant high temperature flow of water. The water temperature and its O_2 content were closely controlled. Some suggestions are made concerning possible steps to be taken to counteract the effect of the above parameters on tension-induced corrosion cracking. (11 refs.) *G.R.S.*

Thermometric study of corrosion behaviour of high strength Al-Mg alloy in phosphoric acid in presence of halides .... See Entry 70061

Long-term corrosion behaviour of metallic drums for low- and medium-level waste forms .... See Entry 70673

Sulphur effect on the oxygen induced segregation phenomena on Ni-30%Cr alloy .... See Entry 72126

Integral emittance of niobium during high-temperature heating and oxidation ... . See Entry 72144

Interaction of O_2 with low index faces of α-CuZn .... See Entry 72248

Mechanism of coalescence of metal particles on a substrate .... See Entry 72275

Electron microscopic and AES studies on thin layers of NiCr [thin film resistors] .... See Entry 72282

The CV product of etched aluminium anode foil .... See Entry 72520

Binding energy of electrons of surface atoms of oxidized 3d transition metals, obtained by the method of appearance-potential spectroscopy .See Entry 72889

The surface chemical bonding investigation of CVD coated tool-steel .... See Entry 72890

The changes of the electron states depending on the depth of surface layers of Al-based alloys .... See Entry 72891

XPS investigation of stainless steel surfaces heated in aqueous media .... See Entry 72963

Some mechanical and electrochemical properties of electroless nickel .... See Entry 73015

Electric-spark alloying (ESA) of steel with titanium carbide in its homogeneity range .... See Entry 73028

Investigation of stresses created by electrically insulating coatings in electrical steel sheet with a ribbed texture .... See Entry 73133

Subsurface plastic deformation in machining 6Al-2Sn-4Zr-2Mo titanium alloy .... See Entry 73163

Investigation into the yield behaviour in the area close to the crack tip of a fine-grained structure steel .... See Entry 73217

The chemical composition of the T15K6 alloy subjected to diamond-electric polishing with applied vibration .... See Entry 73235

Nonresonant laser chemistry in the interaction of intense radiation with matter .... See Entry 73345

Operational experience with a 35 kWp concentrating photovoltaic system .... See Entry 73456

81.70 MATERIALS TESTING

(inc. sample preparation for examination, metallographic techniques, ion and electron microprobe techniques, Auger and photoelectron techniques, defectoscopy; for measurement in the mechanics of solids and rheology, see 46.30R)

73287 Report of a preliminary survey of NDT technolgoy with special reference to offshore structures. W.J.Harris (Univ. Coll., London, England).
Br. J. Non-Destr. Test. (GB), vol.25, no.3, p.117-20 (May 1983).
An assessment is made of the UK research and development effort in the fields of monitoring, inspection and nondestructive examination with the emphasis on nondestructive testing instruments and techniques specific to offshore structures. Remote monitoring using vibration analysis and acoustic emission is discussed. NDT techniques, including magnetic particle inspection, ultrasonic measurements and alternating current field measurements are described. Crack characterisation is discussed. Augmentation of NDT research programmes is recommended. (16 refs.)

73288 Inspection of underwater structures by flooded member detection. A.Bennett, D.Brown (R&D Div., British Gas Corp., Killingworth, England).
Br. J. Non-Destr. Test. (GB), vol.25, no.3, p.131-3 (May 1983).
Describes the concept and design of an ultrasonic system, developed by British Gas Corporation, which relies on the detection of sea water in structural members to indicate the presence of a through-wall defect. Results from the field trials using a prototype flooded member detection system show it to be a viable field inspection tool which allows rapid and reliable inspection to be carried out. (no refs.)

73289 In-service nondestructive inspection of heavy loaded structures in particular underwater structures with leakage flux methods. W.Stumm (Magnetische Prufanlagen GmbH, Reutlingen, Germany).
Br. J. Non-Destr. Test. (GB), vol.25, no.3, p.124-6 (May 1983).
The magnetographic technique used for inspecting welds in underwater structures is described. The advantages of the technique in reduced magnetizing power, separation of inspection procedure from evaluation onboard and for dealing with complicated weld geometries are outlined. (no refs.)

73290 Underwater photography of magnetic particle inspection results. G.Mills, C.Priestley, R.Reid, T.Thirlwell (Oceaneering Internat. Services Ltd., Aberdeen, Scotland).
Br. J. Non-Destr. Test. (GB), vol.25, no.3, p.127-9 (May 1983).
A series of trials, onshore and offshore, have been carried out using combinations of contrast and fluorescent magnetic inks and white and ultraviolet light. The conclusions reached so far indicate that the most effective procedure is to use a highly fluorescent magnetic ink illuminated by an electronic flash gun fitted with a filter that passes only ultraviolet light. The image is recorded on an uprated colour film. This flash UV photography has now been successfully used to record real defects in a structure underwater. (no refs.)

73291 An active dummy cell for use in corrosion studies. R.J.Taylor (Materials Res. Labs., Defence Sci. & Technol. Organization, Melbourne, Australia).
Corros. Sci. (GB), vol.23, no.5, p.457-64 (1983).
A dummy cell based on a gold-bonded germanium diode is described. By contrast with the linear current-voltage response of resistive cells, its electrical performance resembles that of an electrode process with Tafel slopes of 60 mV and ∞ respectively. Its behaviour is predictable for both steady state and transient techniques with the advantage over passive dummy cells that the impedance is potential dependent. (18 refs.)

73292 Micro-hardness of non-irradiated uranium dioxide. S.Kim, O.Takagi, N.Obata, T.Kirihara.
J. At. Energy Soc. Jpn. (Japan), vol.25, no.2, p.140-7 (Feb. 1983). In Japanese.
In order to obtain the optimum conditions for micro-hardness measurements of sintered UO_2, two kinds of hardness tests (Vickers and Knoop) were examined with non-irradiated UO_2 for 2.5 and 5 μm in grain size. The hardness values were obtained as a function of the applied load in the load range of $25\sim1000$ g. In the Vickers test, cracks were generated around the periphery of an indentation even at lower load of 50 g, which means the Vickers hardness is not suitable for UO_2 specimens. In the Knoop test, three stages of load dependence were observed for sintered pellet as well as for a single crystal by Bates (1963). Load dependence of Knoop hardness and crack formation were discussed. In the range of applied load around $70\sim100$ g there were plateau region where hardness values were nearly unchanged and did not contain any cracks in the indentation. The plateau region represents a hardness of a specimen. From a comparison between the hardness values of 2.5 μm and those of 5 μm UO_2, it was approved that the degree of sintering controls the hardness in the plateau region. (8 refs.)

73293 Effect of indenter geometry on controlled-surface-flaw fracture toughness. J.J.Petrovic (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.4, p.277-83 (April 1983).
Fracture toughness values obtained using both Knoop and Vickers-indentation-produced controlled surface flaws were compared as a function of indentation load for a well-characterized glass-ceramic material. At the same indentation load, Knoop cracks were larger than Vickers. As-indented K_C values calculated from fracture mechanics expressions for surface flaws were higher for Knoop flaws than Vickers, but both types gave low K_C values due to indentation residual stress effects. Analysis suggested that theoretical formalisms for indentation residual stress effects based on fracture mechanics solutions for a center-loaded penny crack in an infinite medium should apply to both indentation types. K_C values calculated using the residual stress approach were identical for Knoop and Vickers controlled surface flaws when a 'calibration' value for a constant term in the expression for K_C was used for both indentation types. (13 refs.)

73294 **Examination of delayed fracture tests on prestressing steels.** K.Suehiro, E.Yamashita, S.Mizoguchi (Neturen Co. Ltd., Hiratsuka Plant, Hiratsuka, Japan), M.Tanimura, T.Shimada.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.353, p.222-8 (Feb. 1983). In Japanese.
Three kinds of delayed failure tests have been carried out on induction quenched and tempered SiCr prestressing steel bar and cold drawn prestressing steel wire, under different loading and environmental conditions and using various specimen shapes. (11 refs.)

73295 **Measurement of visual information with texture analysis. II.** M.Hajnal.
Meres & Autom. (Hungary), vol.31, no.3, p.120-7 (1983). In Hungarian.
For pt.I see ibid., vol.30, no.7, p.271-6 (1982). Pt.I contained the requirements for the measurement of textural information, starting from the novel attitude, according to the demands of quality control, summarized the most significant devices and methods and described a new complex texture testing method. The author now demonstrates the applicability of the method through a practical example; classification of high-speed steels on the basis of carbide morphology complemented with fuzzy verification and the phenomenologic examination of the connection between the texture and the material properties. (1 ref.)

73296 **Historical regard to the origin of some partial places in nondestructive testing.** F.Forster.
Mater. Test. (Germany), vol.25, no.5, p.147-52 (May 1983). In German.
Methods are presented for the indication of elastic and inelastic material properties as a function of numerous influencing parameters. The following topics are discussed: introduction of damping capacity into materials research; acoustic emission; crack detection by magnetic leakage flux methods by means of magnetic probes; display of magnetic properties, especially differences in magnetic properties, on a screen; development of impedance plane analysis with eddy current test methods; separation of influencing parameters by impedance plane analysis; eddy current pickup coil test methods with lift-off compensation; electromagnetic quality testing by display on a screen; Forster probe for extremely sensitive measurement of magnetic fields; DC current sorting methods; magnetic point pole method; measurement of low permeabilities; DC magnetography; AC magnetography; a series of test methods integrated in a computer-controlled test block. (42 refs.)

73297 **Economic online inspection of iron castings with X-ray-fluoroscopy and numerically controlled sample handling.** B.Runde.
Mater. Test. (Germany), vol.25, no.5, p.152-4 (May 1983). In German.
The special design of an X-ray inspection system is described, its use for the inspection of cast iron suspension arms. Using a servoelectric handling system, it is possible, to inspect all critical portions of 50 pieces of cast iron suspension arms with a thickness of up to 60 mm in one hour. (no refs.)

73298 **Echo-response of crack-like reflectors in focused ultra-sound-fields. I.** F.Walte, W.Muller.
Mater. Test. (Germany), vol.25, no.5, p.155-8 (May 1983). In German.
It is well known that focusing probes have great advantages in analysing flaws because of their high resolution, but in analyzing flaws one expected that, especially for large flat (crack-like) flaws oriented nearly perpendicular to the surface, an effect would occur called 'mirror-effect', i.e. most of the ultrasonic energy will be deflected mirror-like and therefore missed. The inclination-dependency and the influence of crack-roughness are discussed. (10 refs.)

73299 **Flaw detection on inhomogeneities in dielectrics by radioholography.** A.A.Nadtochii.
Meas. Tech. (USA), vol.25, no.8, p.642-5 (Aug. 1982). Translation of: *Izmer. Tekh. (USSR)*, vol.25, no.8, p.21-3 (Aug. 1982). [received: April 1983]
The scope for using radioholography to measure the deviations in the parameters of a dielectric component from the standard values has been investigated. The results indicate that radioholography enables one to detect deviations in insulating and optically opaque components such as density differences, cracks and other inhomogeneities. The shape of the object can be arbitrary. (2 refs.)

73300 **NDT catches up with composite technology.** S.B.Kulkarni (Morton Thiokol Inc., Brigham City, UT, USA).
Mach. Des. (USA), vol.55, no.9, p.38-45 (21 April 1983).
The technology of nondestructive testing was unprepared for the rapid introduction of composite materials in life-critical applications. Only recently have NDT techniques and equipment been refined sufficiently to cope with the inspection demands of these new materials and applications. But the new inspection methods are costly, and they force users to address the issue of how much NDT is enough. (no refs.)

73301 **Method of analysis of fatigue under complex loading.** A.Le Douaron, T.Lim, R.Lafont (Regie Nat. des Usines Renault, Boulogne, France).
Mem. & Etud. Sci. Rev. Metall. (France), vol.80, no.2, p.105-9 (Feb. 1983). In French.
Presents a materials characterisation example of a series of moterials for the automative industry. The prediction of fatigue fracture of parts is discussed, especially for the cases of a rail, and nonperiodic uniaxial loadings. (no refs.)

73302 **Application of the recording microhardness method to the determination of mechanical material characteristic values of polymers.** M.May, F.Frohlich, P.Grau, W.Grellman (Tech. Hochschule 'Carl Schorlemmer', Leuna-Merseburg, Germany).
Plaste & Kautsch. (Germany), vol.30, no.3, p.149-53 (March 1983). In German.
A new method is described for the continuous measurement of load and indentation during the hardness testing of polymer materials. Analysis of the load line using a special material relationship enables the evaluation of a new hardness number for polymers, differing from the conventional hardness number in that the micro load region is not dependent on the proof load but correlates directly with the inelastic part of the polymer. The new hardness number $L_2VH=2.5\ \sigma_y$ where σ_y is the macroscopic ductile stres. (16 refs.)
A.E.W.

73303 **An experimental study on the relationships between compressibility, fluidity and cohesion of powder solids at small tapping numbers.** M.Yamashiro, Y.Yuasa (Dept. of Planning Technol., Ashikaga Inst. of Technol., Ashikaga, Japan), K.Kawakita.
Powder Technol. (Switzerland), vol.34, no.2, p.225-31 (March-April 1983).
Measurements of cohesion and fluidity are important for industrial control of the properties of powder solids. The compressibility, the fluidity and the cohesion of powder solids are investigated by the method of tapping. In the traditional reports, intervals of N, the tapping number, of 10, 20, 30, 50, 100,... have been widely used. In particular, for powder solids having a small rather than a large particle diameter, the degree of volume reduction C should change significantly with change in tapping number. C decreases gradually if N exceeds a certain value and then does not change when N is increased beyond the tapping number limit. Therefore, C is measured at small intervals of tapping number (1 or 2). A linear relationship between N/C and N is obtained as well as from the traditional results and no unusual phenomenon was observed. It is found, moreover, that Kawakita's formula (1971) relating to compression is applicable. (4 refs.)

73304 **Acoustic emission and its use for the assessment of the strength of ceramic-metal joints.** M.Boniecki, Z.M.Librant, W.W.Wlosinski, W.Mikiel, J.Ranachowski, H.Ryl-Nardzewska.
Szklo & Ceram. (Poland), vol.33, no.2, p.29-34 (July-Aug. 1982). In Polish. [received: April 1983]
The main source of acoustic emissions in ceramics is the propagation of microcracks resulting from any work process. The method enables determination of whether at a given stress level a microcrack is stable. It also makes it possible to investigate the kinetic propagation of cracking. The rate of cracking is a function of the stress coefficient and this relationship is derived mathematically and shown in the form of a curve. The dependence of the number of microscopic cracking processes and the acoustic signals is expressed in the form of an equation and the parameters which affect cracking in ceramics, such as particle size, distance between particles etc. are discussed. An attempt is described to distinguish between acoustic signals resulting from subcritical cracking, macrocracking or surface cracking. The tests were carried out on ceramic cases of diodes, structural details of which are given. A schematic representation of an acoustic detector and test results are presented. The method can be applied as an non-destructive test of ceramic products. (9 refs.) *G.R.S.*

73305 **Statistical modeling of the creep characteristics of structural materials.** A.N.Badaev, E.R.Golubovskii, M.V.Baumshtein, I.P.Bulygin (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.584-9 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.16-20 (May 1982). [received: May 1983]
Using the example of heat-resistance alloys, the authors investigated the feasibility of statistically modeling creep characteristics. An algorithm and program were developed to solve problems of statistically modeling random parameters of an approximate creep equation. The completed work makes it possible to significantly reduce the number and duration of creep tests needed for heat-resistance structural alloys under static thermal and mechanical loads. (10 refs.)

73306 **Prediction of the collapsing pressure of glass fiber-reinforced plastic membranes by the acoustic emission method.** I.S.Guz', A.L.Prokof'ev (Engng. Inst., Acad. of Sci., Kharkov, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.648-54 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.70-5 (May 1982). [received: May 1983]
The authors examined the possibility of using the acoustic emission method for predicting the collapsing pressure of glass fiber-reinforced plastic products subjected to static loading. First they established the dependence of a change in the parameters of the acoustic emission signals when several products were loaded to destruction, and then they kept the load below the value causing destruction, predicted the collapsing load, and in subsequent loading checked the reliability of the prediction. (3 refs.)

73307 **Computation of curves of residual-stress relaxation at normal and elevated temperatures.** N.A.Vishnyakov, G.F.Rudzei.
Strength Mater. (USA), vol.14, no.5, p.687-90 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.101-3 (May 1982). [received: May 1983]
The authors show that the exponential relationship $V=A\sigma_0^n$ (where V is average hourly rate of residual stress relaxation, σ_0 is initial residual stress, and A and n are coefficients dependent on the material, prior history and test conditions) satisfactorily describes the variation in residual stresses in Duralumin specimens with a stress raiser in the interval of tensile loads and thermal exposure parameters investigated. It is thus possible to compute relaxation curves analytically. (3 refs.)

73308 **Equipment for studying structural metallic materials under low-cycle loading conditions with a complex stress state over a wide temperature range.** A.A.Lebedev, F.F.Giginyak, V.V.Storchak, V.V.Bashta, T.N.Mozharovskaya (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.5, p.704-9 (May 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.5, p.115-20 (May 1982). [received: May 1983]
Equipment is described which makes it possible to obtain experimental data for the effect of stress state and temperature on the resistance of structural materials to repeated static alternating loading in the elastoplastic region taking account of stress state and temperature. (8 refs.)

73309 **Instrumentation and methods for scanning Auger microscopy.** M.B.Chamberlain (Sandia Nat. Labs., Albuquerque, NM, USA).
Scanning Electron Microsc. (USA), pt.3, p.937-48 (1982).
The need to determine surface compositions of submicrometer structures in semiconductor devices, metallurgical specimens and a host of other materials has led to many recent advances in the instrumentation and methods for scanning Auger microscopy. Several state-of-the art Auger microprobes employ high emissivity electron sources in the gun assembly and magnetic lenses and coils in the optical column to produce an electron beam with a diameter as small as ≈50 nm. To perform microanalyses of material surfaces with such a small beam without altering the surface composition unacceptably, the placement and efficiency of the electron spectrometer must be optimal; furthermore, the method used to characterize many materials must minimize the dose and/or dose rate. The analytical capabilities of Auger microscopy are being continually improved with the rapid development of ancillary equipment and computer software. (79 refs.)

73310 **Scanning electron microscopy studies on mechanism of rubber tear.** D.K.Setua, S.K.Chakraborty, S.K.De, B.K.Dhindaw (Metall. Engng. Dept., Indian Inst. of Technol., Kharagpur, India).
Scanning Electron Microsc. (USA), pt.3, p.973-80 (1982).
Scanning electron microscopy (SEM) studies of the tearing process of rubber vulcanizates have been made with respect to the following variables: (a) nature of crosslinks (-C-C- and $-S_x$-type); (b) nature of the base polymer (natural rubber and styrene-butadiene rubber); (c) extent of crosslinking; (d) effect of reinforcing filler, HAF carbon black (N 330). Peroxide-cured vulcanizates give rise to stick-slip tear whereas the optimum crosslinked sulfur-cured ones undergo steady tear. In the case of sulfur-cured natural rubber vulcanizates higher crosslink density changes the fracture mode to stick-slip although the tear strength is not influenced much. HAF black-filled vulcanizates undergo brittle fracture. (16 refs.)

73311 Recommended procedure for micro-indentation Vickers hardness test. G.N.Peggs, I.C.Leigh.
Report NPL-MOM-62, Nat. Phys. Lab., Teddington, England (March 1983), 13 pp.
Describes the application of the Vickers microhardness test to metallic specimens at ordinary temperatures. This method is applicable where conventional hardness testing methods, i.e. where the applied load is greater than 9.807 N (1 kgf), are not suitable and where the indentation diagonal length is in the range 20 to 100 μm. (11 refs.)

Cryostat for mechanical testing of materials at 4.2K .... See Entry 70068

Photoacoustic spectroscopy in crystalline semiconductors .... See Entry 70115

Theory of photoacoustic spectroscopy in solids—gas-microphone method .... See Entry 70116

Nondestructive analysis of the structure of pressure vessel steels by micromagnetic testing techniques .... See Entry 70690

Recording length-criteria used for ultrasonic testing .... See Entry 70691

Improvement of ultrasound testing by the installation of electronically controlled test equipment (phased arrays) .... See Entry 70692

Acoustic emission measurements on large specimens in the research program into component safety (FKS) .... See Entry 70693

The influence of the flow and material characteristics on failure analysis .... See Entry 70694

Time-dependence of fracture mechanics properties .... See Entry 70697

PWR nozzle 'crotch corner' inspection: an effective additional ultrasonic technique for radial cracks .... See Entry 70716

Ultrasonic wave propagation in a layered medium under different boundary conditions .... See Entry 71280

Coherency strain fields: magnitude and symmetry .... See Entry 71846

Study of the swelling of an Al-Ar-O alloy by an acoustic emission method .... See Entry 72142

Design and operation of a high efficiency magnetron sputter coater .... See Entry 72990

Dependence of the dielectric properties, porosity, and apparent density of quartz ceramic on the phase of composition .... See Entry 73047

Effect of zinc content on the annealing behaviour of deformed alpha-brasses .... See Entry 73106

Numerical determination of the parameters of Krupkowski's function for a torsion test taking into consideration the strain hardening ranges .... See Entry 73108

The use of acoustic emission techniques to monitor fracture processes in high strength precipitation hardened aluminum alloys .... See Entry 73168

Dynamic fatigue of brittle materials containing indentation line flaws .... See Entry 73180

Thermal shock resistances and fracture toughnesses of SiC and B_4C disks at elevated temperature .... See Entry 73193

Fracture mechanics properties for thermal shock of the mesophase pitch carbons during the graphitizing heat treatment process .... See Entry 73194

Thermal shock resistance and fracture toughness of graphite with different arrangements of coke grain size and porosity .... See Entry 73195

The effect of temperature, specimen size, and geometry on the fracture toughness of a 3 pct NiCrMoV low pressure turbine disc steel .... See Entry 73205

82.00 PHYSICAL CHEMISTRY

82.20 CHEMICAL KINETICS

73312 Multivariate master equation and its wave solutions. Chen Zhuen-xion, Ho Yu-ping (Inst. of Plasma Phys., Acad. Sinica, Hefei, China).
Acta Phys. Sin. (China), vol.32, no.3, p.285-93 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The wave solutions of multivariate master equation for linear reaction system $A \rightleftharpoons X$ have been discussed. Except for the density waves which are obtainable from the usual reaction diffusion equation and multiwave solutions, it is not possible to obtain any fluctuation wave branch. The authors note that, due to the large difference between the spatial scales of chemical reaction and diffusion, it is doubtful to use the multivariate master equation in analysing the critical behaviour of non-linear system. (5 refs.)

73313 Arbitrary order functional sensitivity densities for reaction-diffusion systems. D.K.Dacol, H.Rabitz (Dept. of Chem., Princeton Univ., Princeton, NJ, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4905-14 (15 April 1983).
The concept of functional sensitivity analysis in the study of diffusion processes in a chemically reacting environment is reviewed and extended to include the notion of arbitrary order functional sensitivity densities. A new perspective on its physical and mathematical basis is offered through a detailed discussion of the motivation behind the formal procedure adopted. The arbitrary order functional sensitivity densities (defined as arbitrary order functional derivatives of a chemical species concentration with respect to the space and time dependent parameters of the system) are shown to obey certain differential equations that can be solved with the help of a Green's function. This Green's function is the inverse of a differential operator that defines an associated linear system in the application of Lyapunov's learized stability theory to (in general nonlinear) reaction-diffusion systems. It is found that the Green's function can be regarded as a concentration response function which allows for an interpretation of the sensitivity densities as generalized response functions. Finally, an illustration of the use of those techniques is provided by applying them to the case of a linear reaction-diffusion system. (17 refs.)

Singular perturbation expansion for Markovian master equations .... See Entry 69982

On the regeneration mechanism of $HgBr_2$ in $HgBr/HgBr_2$ dissociation lasers .... See Entry 71113

Fluctuations in the interface between two phases .... See Entry 72078

Solvent effect in the Diels-Alder reaction .... See Entry 73314

Quantum state to state reactive probabilities: the $H(D)+Cl_2(v) \rightarrow H(D)Cl(v')+Cl$ reactions .... See Entry 73315

The reaction pathway for the hydration of ketenimine by water dimer. An ab initio study .... See Entry 73317

The cyano group as a model for an electron-withdrawing substituent: two examples .... See Entry 73319

The state-selective reactions of vibrationally excited $CH(X^2\Pi)$ with oxygen and nitrogen .... See Entry 73325

A laser method of examining metal ignition kinetics .... See Entry 73335

Reactions of excited $I^*(^2P_{1/2})$ and unexcited $I(^2P_{3/2})$ iodine atoms in perfluoroalkyl radicals .... See Entry 73351

Enhanced char reactivity via a tailored pore structure .... See Entry 73362

Statistical rates for reactions on a heterogeneous surface .... See Entry 73363

Influence of aluminum adatoms on the germanium oxidation process .... See Entry 73371

82.20K Potential energy surfaces for chemical reactions

(see also 31.70F -in atomic and molecular physics, 34.20 Intermolecular forces, 34.50L Atomic and molecular beam studies)

Quantum state to state reactive probabilities: the $H(D)+Cl_2(v) \rightarrow H(D)Cl(v')+Cl$ reactions .... See Entry 73315

A semiclassical approach to the dynamics of chemical reactions within the hyperspherical formalism .... See Entry 73316

Rotational excitation in the carbon monoxide product of ketene photodissociation .... See Entry 73355

82.20R Energy distribution and transfer, relaxation

(see also 31.70H Time-dependent phenomena in atomic and molecular physics)

Rotational excitation in the carbon monoxide product of ketene photodissociation .... See Entry 73355

82.30 SPECIFIC CHEMICAL REACTIONS; REACTION MECHANISMS

73314 Solvent effect in the Diels-Alder reaction. L.Pardo, V.Branchadell, A.Oliva, J.Bertran (Dept. de Quimica Fisica, Univ. Autonoma de Barcelona, Barcelona, Spain).
THEOCHEM (Netherlands), vol.10, p.255-60 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The solvent effect on the rate constant, regioselectivity and stereoselectivity of the Diels-Alder reaction between 1-hydroxybutadiene and acrolein has been studied theoretically by means of the cavity model. The results obtained are in good agreement with the experimental facts. The fundamental role of charge transfer in the increase of selectivity with the solvent is discussed. (23 refs.)

73315 Quantum state to state reactive probabilities: the $H(D)+Cl_2(v) \rightarrow H(D)Cl(v')+Cl$ reactions. J.M.Alvarino (Dept. de Quimica Fisica, Univ. del Pais Vasco, Bilbao, Spain), A.Lagana'.
THEOCHEM (Netherlands), vol.10, p.271-5 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Quantum detailed reactive probabilities for the title reactions have been computed on an optimized LEPS surface. Results are compared with quantum and quasiclassical probabilities reported in the literature. Effects of increasing the reactants' translational energy and changing the mass of the impinging atom are also investigated. (16 refs.)

73316 A semiclassical approach to the dynamics of chemical reactions within the hyperspherical formalism. V.Aquilanti, S.Cavalli, G.Grossi, A.Lagana (Dipartimento di Chimica, Univ. di Perugia, Perugia, Italy).
THEOCHEM (Netherlands), vol.10, p.319-23 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Semiclassical techniques are introduced within the hyperspherical coordinate approach, which allows the reduction of many-body problems to the multichannel close coupling formalism in terms of a single (hyper)radial variable. The theory, when applied to collinear chemical reactions, leads to the computation of adiabatic energy levels, and to estimates of nonadiabatic coupling elements. Comparisons are carried out with exact quantum results for the reactions $H+H_2$, $I+HI$, $H+FH$, and their isotopic variants. It is shown that the theory predicts accurately resonance properties and interference effects in reaction probabilities. (7 refs.)

73317 The reaction pathway for the hydration of ketenimine by water dimer. An ab initio study. Minh Tho Nguyen (Dept. of Chem., Univ. of Leuven, Heverlee, Belgium), A.F.Hegarty.
THEOCHEM (Netherlands), vol.10, p.329-32 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The reaction pathway for the hydration of the ketenimine $CH_2=C=NH$ by H_2O and $(H_2O)_2$ has been investigated by ab initio methods using STO-3G and 4-31G basis sets, optimized geometries of stationary points being determined by the gradient method. The preferred reaction is with the water dimer which, although it enters the transition state correctly oriented for proton transfer to the β-carbon, does not actually transfer this proton until after the transition state. The reaction is calculated (4-31G) to have an activation barrier of 22 kcal/mole, most of which arises due to the deformation of ketenimine and water dimer. The reaction with water monomer is far less favoured (activation barrier 67 kcal/mole using the same basis set). (11 refs.)

73318 A perturbational molecular orbital analysis of the cycloaddition of 2-carbomethoxy-1,4-benzoquinone to vinylcyclohexene. D.Pitea (Inst. of Phys. Chem., Milano, Italy).
THEOCHEM (Netherlands), vol.10, p.347-52 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The application of the intermolecular orbital method to the orientation phenomena in the Diels-Alder reaction of vinylcyclohexene with carbomethoxy-p-benzoquinone is discussed in relation to the frontier orbital approximation and to the limits of the adopted method. (7 refs.)

73319 The cyano group as a model for an electron-withdrawing substituent: two examples. F.Delbecq (Lab. de Chimie Theorique, Univ. de Paris-Sud, Orsay, France).
THEOCHEM (Netherlands), vol.10, p.353-7 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The cyano group is largely employed in synthesis for its electron-withdrawing character. But its use in theoretical calculations causes a lot of problems in the study of some reactions, in particular those in which a geometry change occurs or in which the possibility of resonance between several forms exists. Two examples illustrate these difficulties. (11 refs.)

73320 Kinetics of plasmachemical conversion in a silent electrical discharge. J.Rutkowsky, H.Drost, R.Mach (Zentralinst. fur Phys. Chem., Akad. der Wissenschaften, Berlin, Germany).
Beitr. Plasma Phys. (Germany), vol.23, no.2, p.181-91 (1983). In German.
In a silent electrical discharge of barrier type operated at 50 Hz, 10 resp. 20 kV alternating voltages and pressures of $3.32\text{-}9.96\times10^4$ Pa methane was plasmachemically converted to simple hydrocarbons. Ethane and propane were identified as main gaseous products, whereas butane, acetylene, ethylene and propylene occurred in distinct lower concentrations. The decay of methane in dependence on discharge time corresponds up to 1000 s strongly to an exponential function. The formation of alkanes especially ethane follows according to the scheme of a successive reaction; it can be well described kinetically by a 1st order rate equation. (10 refs.)

73321 Pyrolysis products in ion/molecule reactions. II. Amines, thiols, and esters. G.Caldwell, J.E.Bartmess (Dept. of Chem., Indiana Univ., Bloomington, IN, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.235-43 (15 May 1983).
For pt.I see ibid., vol.40, p.279 (1981). The title compounds undergo pyrolytic decomposition on the hot filament of an ionization gauge in an ICR mass spectrometer. The products of pyrolysis are detected by their negative ion/molecule reactions. (22 refs.)

73322 A study of the collision-induced dissociation of $C_2H_5OH_2^+$ using various target gases. P.H.Dawson (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.287-97 (15 May 1983).
A triple quadrupole mass spectrometer was used to study the collision-induced dissociation of $C_2H_5OH_2^+$ using Ar, Kr, N_2, CH_4, C_2H_6 and C_3H_8 as target gases. The principal fragments were $m/z=29$, 27 and 19. Approximate cross-sections were determined for each decomposition pathway. The products were examined as a function of collision energy up to 75 eV. Threshold energies in the centre-of-mass system were in reasonable agreement with thermochemical values. An extensive survey was made of the fragment ion energy distributions. The $m/z=29$ and 19 fragments, which are easily formed, had relatively narrow distributions which also indicated small scattering angles. At the lower collision energies, the $m/z=29$ ion, which has a higher threshold for its formation, had a very broad distribution indicating a wide range of scattering angles. For the $m/z=29$ and 19 fragments, polyatomic targets gave consistently lower fragment energies than the rare gases. The data also suggest an inverse correlation between scattering angle and collision energy. (13 refs.)

73323 The angular distribution of fragment ions produced from polyatomic ion collisions. P.J.Todd, R.J.Warmack, E.H.McBay (Analytical Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.299-313 (15 May 1983).
Energy released to daughter ions from collision-induced dissociation of high energy (~keV) CH_4^+, $CH_3NO_2^+$ and CS_2^+ is measured. Fragmentation mechanics are developed to enable calculation of the angular distribution of fragments due to energy released. Subsequent plots of fragment-ion relative abundance vs. laboratory angle fit published experimental data, even though collisional scatter is presumed negligible. (25 refs.)

73324 Dissociation constants of amino acids in isopropanol+water mixtures. B.P.Dey, S.Dutta, S.C.Lahiri (Dept. of Chem., Univ. of Kalyani, Kalyani, India).
Indian J. Chem. A, vol.21A, no.9, p.886-90 (Sept. 1982). [received: May 1983]
The *pK* values of a number of amino acids have been determined in isopropanol+water mixtures of varying compositions *p*H-metrically. The results show that the changes in pK_1 values are smaller compared to those in the corresponding carboxylic acids, but the changes in pK_2 values are only marginal. It is apparent that the ratio of zwitterions decreases as the [organic solvent] increases. It has been found that the specific solute-solvent interactions are of importance in explaining the change in *pK* values but their nature is not well understood. (17 refs.)

73325 The state-selective reactions of vibrationally excited $CH(X^2\Pi)$ with oxygen and nitrogen. J.A.Duncanson,Jr., W.A.Guillory (Dept. of Chem., Univ. of Utah, Salt Lake City, UT, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4958-62 (15 April 1983).
The reaction rate constants for the reaction of $CH(X^2\Pi, v''=0, 1)$ with O_2 and N_2 have been measured. CH was produced by IR multiple photon dissociation of methanol and probed by laser induced fluorescence of the $A(0,0)$ (431 nm) and $A(0,1)$ (488 nm) transitions. The second order rate constants are k_{02} $(v''=0)=2.1\times10^{-12}$ cm^3 molecule^{-1} s^{-1}, k_{02} $(v''=1)=4.3\times10^{-12}$ cm^3 molecule^{-1} s^{-1}, k_{N2} $(v''=0)=7.1\times10^{-14}$ cm^{-3} molecule^{-1} s^{-1}, and k_{N2} $(v''=1)=3.0\times10^{-12}$ cm^3 molecule^{-1} s^{-1}. The rate constants for CH $(v''=1)$ are the observed combined rate constants for reaction and vibrational relaxation. (20 refs.)

73326 An analysis of the density dependence of the butane isomerization rate. G.T.Evans (Dept. of Chem., Oregon State Univ., Corvallis, OR, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4963-8 (15 April 1983).
A Fokker-Planck (FP) and a BGK-like collision operator are used in the analysis of the torsional dynamics of butane. Using previously derived kinetic equations, the authors have determined the torsional correlation time τ as a function of the density (or friction). The inverse of the torsional correlation time, or the isomerization rate, goes to zero at low density, reaches a maximum at an intermediate density, and decreases monotonically for higher densities. Predictions of the FP and BGK-like theories of the isomerization correlation time agree with the classic Chandrasekhar-Kramers result at high to moderate densities, and with stochastic molecular dynamics calculations of Montgomery, Holmgren, and Chandler (1980). (21 refs.)

73327 Orientation dependence in the reaction of Xe* with photodissociation polarized IBr. M.S.de Vries, V.I.Srdanov, C.P.Hanrahan, R.M.Martin (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5582-9 (1 May 1983).
The reaction of metastable Xe* with IBr to produce XeI* and XeBr* excimers was studied in crossed molecular beams. The IBr beam was rotationally polarized by using laser photodissociation to selectively remove most of the *M* state distribution. The reaction cross section was found to be largest when the Xe* approaches parallel to the plane of rotation of the IBr, and smallest when the Xe* approaches perpendicular to the plane of rotation. Reaction models for excimer formation are discussed, and it is concluded that the observed steric effect results from the anisotropy of the ionic $Xe^+/IBr^-(^2\Pi)$ potential surface, involving the first excited state of IBr^-, which is the intermediate state in the formation of XeI*. (28 refs.)

73328 Theoretical analysis of the quantum contributions to the reactions $H_2(v=1)+H\rightarrow H+H_2(v'=0,1)$ and $H_2(v=1)+D\rightarrow H+HD(v'=0,1)$. R.B.Walker (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), E.F.Hayes.
J. Phys. Chem. (USA), vol.87, no.7, p.1255-63 (31 March 1983).
Detailed quantum-dynamical calculations of the Siegbahn-Liu-Truhlar-Horowitz (SLTH) surface are reported for a rotating linear model (RLM) approximation with and without corrections for bending zero-point energy. These dynamical results predict that there are substantial prethreshold quantum contributions to state-selected cross sections and rate constants for both of the title reactions. However, the mechanisms for these prethreshold quantum effects are not the same. For $H_2(v=1)+H$, a threshold resonance is responsible for the large prethreshold quantum contribution: 65% of the total rate of 300K. For $H_2(v=1)+D$, tunneling is found to be large, leading to a 66% prethreshold quantum contribution at 300K. These large quantum corrections are not large enough to provide an explanation for the previously identified discrepancy between the experimental and classical theoretical rate constants for these reactions. (40 refs.)

73329 Diffusion-controlled reaction of water with glass. R.H.Doremus (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.143-7 (April 1983).
A model in which the diffusion of molecular water controls the rate of reaction of water with glass is considered. As a result of a number of questionable aspects of this model, it is concluded that the ion exchange mechanism is still the best one for the diffusion-controlled reaction of water with alkali silicate glasses. (14 refs.)

73330 Possibility of using recombination reactions and alkali metals to obtain inversion on atomic iodine. T.L.Andreeva, V.I.Babkin, A.I.Maslov, I.I.Sobel'man, E.A.Yukov.
J. Sov. Laser Res. (USA), vol.4, no.1, p.84-91 (Jan.-Feb. 1983).
The possibility of producing a continuous-flow laser operating on an atomic iodine transition is considered. Population inversion is the result of depletion of the lower laser level on account of predominant recombination into iodine molecules in the ground state. Alkali-metal atoms are used to obtain atomic iodine and free radicals without consumption of electric energy. The use of an electric discharge is proposed for the excitation of atomic iodine. The kinetics of the basic chemical reactions is considered and the possibility is demonstrated of obtaining inversion at reasonable working-mixture parameters. The schematic diagram of the laser setup is discussed. (14 refs.)

73331 Charge-transfer interactions with *N*-methylquinolinium ion as electron acceptor. A.S.N.Murthy, A.P.Bhardwaj (Dept. of Chem., Indian Inst. of Technol., New Delhi, India).
Spectrochim. Acta Part A (GB), vol.39A, no.5, p.415-18 (1983).
The charge-transfer interactions of *N*-methylquinolinium ion with aniline and substituted anilines have been investigated by electronic absorption spectroscopy and thermodynamic data determined. The thermodynamic and spectroscopic data has been used to obtain empirical energy parameters from Mulliken's theory. (16 refs.)

73332 An ab initio calculation of the dissociation $C_2H_2(^1\Sigma^+)\rightarrow C_2H(^2\Sigma^+)+H(^2S)$. S.Polezzo (CNR, Milano, Italy), M.Raimondi, M.Simonetta.
Theor. Chim. Acta (Germany), vol.62, no.5, p.477-81 (1983).
The collinear dissociation of acetylene to C_2H and H is studied by a generalized self-consistent procedure. The dissociation energy, the C-H force constant and stretching frequency are computed. (6 refs.)

73333 Determination of the trans-cis-relaxation rate in polymethyne dye molecules. M.V.Bondar, V.I.Bezrodnyi, A.V.Marinchenko, E.A.Tikhonov.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.521-5 (April 1983). In Russian.
Nonstationary populations of energy levels in the model of polymethyne dye ПК-693 have been calculated by the Runge-Kutta 4th order method. Dependences of the nonstationary populations vs. the model parameters are analyzed. The constant of trans-cis-relaxation has been determined for polymethyne dye ПК-693 by comparison of the experimental and theoretical data. (7 refs.)

Theoretical investigation on hydroformylation reactions. III. Hydrocarbonyliron-propylene π-intermediates ....See Entry 70781

MCSCF/CI investigation of the low-lying potential energy surfaces of the formyloxyl radical, HCO_2 ....See Entry 70791

Vibrational kinetics in He-CO reacting discharges ....See Entry 70858

Interconversion studies and characterization of asymmetric and symmetric dinitrogen trioxide in nitric oxide matrices by Raman and infrared spectroscopy ....See Entry 70863

^{23}Na nuclear magnetic resonance linewidth studies of sodium tetraethylaluminate: complexes with hexamethylphosphoramide in benzene ....See Entry 70901

Excited-state dynamics of 3-hydroxyflavone ....See Entry 70939

Excited-state intramolecular proton transfer and vibrational relaxation in 2-(2-hydroxyphenyl)benzothiazole ....See Entry 70940

Solvation and conformation of methanol in water ....See Entry 70982

A multi-reference approach to energy decomposition for molecular interactions ....See Entry 70985

Production of O^- from CO_2 by dissociative electron attachment ....See Entry 70987

On the regeneration mechanism of $HgBr_2$ in $HgBr/HgBr_2$ dissociation lasers ....See Entry 71113

Nonpolar solute-water pair correlation functions—a comparison between computer simulation and theoretical results ....See Entry 71856

Order-disorder transitions and solid state reaction kinetics in Na_2SO_4-K_2SO_4 system. I ....See Entry 72098

Multivariate master equation and its wave solutions ....See Entry 73312

Arbitrary order functional sensitivity densities for reaction-diffusion systems ....See Entry 73313

Thermal stability/structure relations of some polynitroaliphatic explosives ....See Entry 73339

Reactions of excited $I^*(^2P_{1/2})$ and unexcited $I(^2P_{3/2})$ iodine atoms in perfluoroalkyl radicals ....See Entry 73351

Study of correlation effects in the calculation of heats of reactions .... See Entry 73357

Heterogeneous reactions and chemical transport of molybdenum with halogens and oxygen under steady state conditions of incandescent lamps .... See Entry 73360

Equilibrium aggregation in a moderately concentrated finely dispersed system .... See Entry 73374

82.35 POLYMER REACTIONS AND POLYMERIZATION

73334 Equilibrium polymerization in two dimensions. M.V.Jaric, K.H.Bennemann (Inst. for Theoretical Phys., Freie Univ. Berlin, Berlin, Germany).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.127-30 (18 April 1983).
A mean-field theory of equilibrium polymerization on a square lattice is presented. A novel feature of the model is the treatment of the whole range of rigidity of polymers (from flexible to stiff) as well as a simultaneous account of both polymer rings and excluded volume. As a result a line of tricritical points is found. (5 refs.)

Hydrophilic polymeric membranes obtained by radiation cast-copolymerization of ethyl acrylate with various monomers .... See Entry 73137

82.40 CHEMICAL KINETICS AND REACTIONS: SPECIAL REGIMES

73335 A laser method of examining metal ignition kinetics. V.I.Konov, V.G.Ral'chenko, V.N.Tokarev (Lebedev Phys. Inst., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.49-52 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1065-9 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
When a laser acts on a metal in air, the exothermic oxidation at high temperatures may make a contribution to the heating comparable with that from the laser. Quantitative estimates have been made for titanium in air, but no direct measurements have been made of the rate of heat release due to oxidation at the surface. It is desirable to perform such experiments not only because it is necessary to estimate the role of chemical factors in laser working materials, but also if one knows the time course of the heat production from the reaction one can establish the kinetic parameters and thus identify specific features in the laser oxidation. The authors describe a method of examining the ignition kinetics of a metal in response to continuous-wave laser radiation, which involves direct measurement of the heat production by oxidation. (5 refs.)

73336 The induction period of a thermal explosion in a gas between infinite parallel plates. J.Poland (Mech. Engng. Dept., Univ. of Maine, Orono, ME, USA), D.R.Kassoy.
Combust. & Flame (USA), vol.50, no.3, p.259-74 (April 1983).
A study is made of the initiation of gas dynamical processes during the induction period of a high activation energy supercritical thermal explosion in a reactive gas confined between two infinite parallel plates. The detailed development of the density, velocity, temperature and fuel mass fraction fields during the induction period is separated into three phases. During the first phase, occurring on the acoustic time scale of the vessel, conduction-dominated boundary layers generate an acoustic field in a nondissipative interior core region. The second phase, occurring on the conduction time scale of the vessel, is characterised by a pointwise competition between reaction-generated heat release, conduction, and compression. In a supercritical system, $\delta > \delta_{crit}$, the third phase, of extremely limited duration, is dominated by the development of a tiny self-focussing hot spot embedded within a nearly invariant conduction-dominated field filling most of the vessel. (35 refs.)

73337 Flame development in spark-ignition engines. A.Thomas (Cambridge Univ. Engng. Dept., Cambridge, England).
Combust. & Flame (USA), vol.50, no.3, p.305-22 (April 1983).
A theory is developed based on the simple postulation that the rate of burning is the product of flame surface area and laminar burning velocity. The concept of a turbulent burning velocity is thereby not required, and attention is focussed instead on the processes by which flame area increases during combustion. Much is made of the concept of 'flame-stretching' introduced by B. Karlowitz (1953) and of the influence of velocity gradients on this property. Attention is paid to the effect of the complementary component of gas velocity, i.e. that tangential to the flame front. The treatment is independent of assumptions of the thickness of the flame front, and all chemical considerations are incorporated into the property of laminar burning velocity. (20 refs.)

73338 Sensitivity analysis for premixed, laminar, steady state flames. T.P.Coffee, J.M.Heimerl (ARRADCOM, Ballistic Res. Lab., Aberdeen Proving Ground, MD, USA).
Combust. & Flame (USA), vol.50, no.3, p.323-40 (April 1983).
The authors discuss the modelling of premixed, laminar, one-dimensional steady state flames. Such models require a large number of input parameters, the values of which may have large uncertainties. To determine the importance of a given input parameter in evaluating an output function, it is useful to be able to perform a sensitivity analysis. A computer program has been developed to do this for any given flames. The output functions are expressed as Taylor expansions. Both first- and second-order sensitivity coefficients can be computed. As a test case, a sensitivity analysis was carried out for a set of H_2-O_2-N_2 flames. The computed sensitivity coefficients show clearly which mechanisms are important for a given flame. (13 refs.)

73339 Thermal stability/structure relations of some polynitroaliphatic explosives. K.F.Mueller, R.H.Renner, W.H.Gilligan, H.G.Adolph, M.J.Kamlet (Naval Surface Weapons Centre, White Oak Lab., Silver Spring, MD, USA).
Combust. & Flame (USA), vol.50, no.3, p.341-9 (April 1983).
Thermal stability/chemical structure relations were investigated for different classes of energetic compounds containing trinitromethyl, fluorodinitromethyl, and gem-dinitroethyl groups. In the vacuum thermal stability test used to determine the thermal characteristics of the materials, samples are heated to elevated temperatures under vacuum and the amounts of gaseous decomposition products are measured. The following results were obtained: (a) The thermal stabilities of energetic compounds containing trinitromethyl groups are lower than those of materials containing fluorodinitromethyl or gem-dinitroethyl groups if these groups are in a sterically unhindered environment; (b) Energetic materials containing $C(NO_2)_3$-, $FC(NO_2)_2$-, or $CH_3C(NO_2)_2$- groups in an environment which is sterically hindered by neighbouring bulky substituents all have substantially decreased thermal stability compared to unhindered materials. (11 refs.)

73340 The application of silent electric discharges to propagating flames. T.Inomata, S.Okazaki, T.Moriwaki, M.Suzuki (Dept. of Chem., Faculty of Sci. & Technol., Sophia Univ., Tokyo, Japan).
Combust. & Flame (USA), vol.50, no.3, p.361-3 (April 1983).
The authors show it is possible to produce many active species by a silent electric discharge, but, to promote combustion, it is necessary to keep the time interval from production of active species to combustion as short as possible. It is also necessary to ensure that the combustion zone is kept away from the electric field because premature oxidation and field-induced quenching are both counterproductive. (5 refs.)

A miniature ionisation probe technique using a multilayer circuit board for the study of explosive phenomena in primary and secondary explosives .... See Entry 70072

Equation of equilibrium emission and retardation parameters in nuclear-power-plant turbines with dissociating nitrogen tetroxide .... See Entry 70712

Infrared emission spectrum and potential constants of HCl ..... See Entry 70868

Flame spread in an opposed flow with a linear velocity gradient .... See Entry 71663

Enhanced char reactivity via a tailored pore structure .... See Entry 73362

Oxygen permeable membrane for oxygen enriched combustion .... See Entry 73368

82.40T Chemiluminescence and chemical laser kinetics

(see also 42.55K Chemical lasers, 78.60P Chemiluminescence)

Possibility of separating the isotopes ^{127}I and ^{129}I with the aid of a photodissociation iodine laser .... See Entry 71029

On the regeneration mechanism of $HgBr_2$ in $HgBr/HgBr_2$ dissociation lasers .... See Entry 71113

Photochemical xenon-oxide laser .... See Entry 71114

Possibility of using recombination reactions and alkali metals to obtain inversion on atomic iodine .... See Entry 73330

Photolysis of compounds with P-I and As-I bonds .... See Entry 73348

Photodissociation of the molecules $SiCl_3I$ and SiF_3I .... See Entry 73349

Possibility of lasing in the visible band by molecule photodissociation .... See Entry 73350

Reactions of excited $I^*(^2P_{1/2})$ and unexcited $I(^2P_{3/2})$ iodine atoms in perfluoroalkyl radicals .... See Entry 73351

82.45 ELECTROCHEMISTRY AND ELECTROPHORESIS

(see also 66.10 Ionic conduction in liquids; for electro-osmosis, see 82.65)

73341 Multielectron transfer across the metal electrolyte interface in electrochemical systems. S.Efrima (Dept. of Chem., Ben Gurion Univ. of the Negev, Be'er Sheva, Israel).
Isr. J. Chem. (Israel), vol.22, no.4, p.401-7 (1982).
The theory for the rate of multielectron transfer across the metal electrolyte interface in electrochemical systems is developed. The two-electron case is specifically considered and compared to the one-electron case. The two-electron path may become more important than the parallel one-electron channel under certain well-specified circumstances. (8 refs.)

73342 The electrochemistry of molten lithium chlorate and its possible use with lithium in a battery. S.C.S.Wang, D.N.Bennion (Chem. Engng. Dept., Univ. of California, Los Angeles, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.741-7 (April 1983).
Lithium chlorate, $LiClO_3$, has reported melting points of 127.6° and 129°C. The specific conductance of molten lithium chlorate at 130°C is relatively high compared to common aqueous electrolytic solutions at room temperature. Therefore, lithium chlorate offers the chance to operate a new lithium battery system at a temperature between 30° and 150°C. It was found experimentally that lithium chlorate is stable in the potential range between 3.2 and 4.6 V relative to an Li reference electrode. An Li-Cl_2 secondary battery system was observed to have an open-circuit potential of 3.97 V, making an Li-Cl_2 secondary battery in molten lithium chlorate possible, in principle. A lithium-lithium chlorate primary battery system is also possible. Lithium negative electrode performance was found to be hindered by corrosion and possible runaway reactions with $LiClO_3$. Dendrite formation on charging was observed. The solubility of Li_2O and LiCl in $LiClO_3$ at 145°C is 7.5×10^{-5}d and 1.78×10^{-3} mol/cm^3, respectively. The diffusion coefficients are 1.5×10^{-7} for Li_2O and 3.4×10^{-7} cm^2/sec for LiCl. Platinum appeared to be an inert positive electrode for chlorate, chlorine, or oxygen reactions for runs on the order of several hours. Nickel shows an active-passive behavior which is complex. Nickel appears suitable for use in a primary cell for the cathodic discharge of $LiClO_3$, but it does not appear suitable for a Cl_2 or O_2 electrode. (12 refs.)

73343 Electrolytic recovery of precious metals from dilute aqueous solutions. F.C.Walsh (Chem. Dept., Univ. of Southampton, Southampton, England).
Colloquium on New Tools for Industrial Processes, London, England, 14 April 1983 (London, England: IEE 1983), 9 pp.
Provides a brief profile of some modern electrolytic cell designs, including performance data; to remove and recover metals from dilute industrial process streams. The author discusses case studies of developed designs of: Chemelec cell; bipolar trickle tower reactor; metamatic cyclone cell; Eco-cell; cascade Eco-cell. While the examples given relate to silver, gold and platinum group metals, the cells have also been used to treat a wide variety of the more base metals including, copper, cadmium, nickel, and zinc. (17 refs.)

CANDU with hydrogen .... See Entry 70722

A modified constriction model for the resistivity of a bubble curtain on a gas evolving electrode .... See Entry 71686

Interface between solid electrode and solid electrolyte—a study of the $Li/LiI(Al_2O_3)$ solid-electrolyte system .... See Entry 72153

Stability of semiconducting TiO_2 photoanodes .... See Entry 72444

Analytic expression of the Warburg impedance for a rotating disk electrode .... See Entry 72458

Cathodoluminescence of anodically grown SiO_2 films .... See Entry 72874

Corrosion study of a carbon steel in neutral chloride solutions by impedance techniques .... See Entry 73268

Corrosion inhibition study of a carbon steel in neutral chloride solutions by impedance techniques .... See Entry 73269

Standard free energy of formation of iron iodide .... See Entry 73358

High temperature solar electrothermal processing—zinc from zinc oxide .... See Entry 73410

The relation between performance and stability of Cd-chalcogenide/polysulfide photoelectrochemical cells. I. Model and the effect of photoetching .... See Entry 73465

The electrophoretic mobilities of minerals determined by laser Doppler velocimetry and their relationship with the biological effects of dust towards macrophages .... See Entry 73546

82.50 PHOTOCHEMISTRY AND RADIATION CHEMISTRY

(see also 33.50 Fluorescence, phosphorescence; radiationless transitions)

73344 Dynamics and spatial structure of the absorption at the photochemical stage in insulator destruction. N.M.Bityurin, V.N.Genkin, V.V.Sokolov (Inst. of Appl. Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.38-42 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1052-7 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
The photochemical stage in damage to an insulator is considered by reference to polymers. Three-dimensional effects have been identified in the physicochemical processes characteristic of photodestruction. There is a relationship between the distribution of the absorbing products and the mechanisms of the chemical reactions, which provides a new method of examining such processes in solids. For example, the dimensions and position of the localization regions have been established for the photooxidation products from polyvinyl chloride, as well as the regions of elevated concentration of polyene structures. (17 refs.)

73345 Nonresonant laser chemistry in the interaction of intense radiation with matter. A.M.Bonch-Bruevich, M.N.Libenson.
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.6, p.82-94 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.6, p.1104-18 (1982). [received: April 1983] (Proceedings of the Fifth All-Union Conference on Nonresonant Interaction of Optical Radiation with Matter, Leningrad, USSR, 1-4 Dec. 1981).
The heterogeneous laser oxidation of a metal in air is considered as regards the effects of the oxidation on the change in optical parameters and heating rate produced by pulsed or continuous-wave radiation. The thermochemical mechanisms of optical breakdown are considered for transparent condensed media of complex composition, together with the effects of the decomposition of the temperature dependence of the absorption coefficient at high light intensities. (49 refs.)

73346 Electron trapping in alcohol clusters in γ-irradiated alcohol-2,2,4-trimethylpentane-2,2-dimethylbutane glasses at 77K. T.Kimura, K.Yasuda, S.Fukuda, K.Fueki (Dept. of Synthetic Chem., Nagoya Univ., Nagoya, Japan).
Can. J. Chem. (Canada), vol.61, no.3, p.553-7 (March 1983).
An optical absorption study has been made on electrons (e_{alc}^-) trapped in alcohol clusters in γ-irradiated 1-propanol (PrOH)-2,2,4-trimethylpentane (TMP)-2,2-dimethylbutane (DMB), 1-butanol (BuOH)-TMP-DMB, and 1-pentanol (PnOH)-TMP-DMB mixture glasses at 77K. Hitherto electron transfer from the hydrocarbon region into alcohol clusters has been known to be a major process for e_{alc}^- formation in γ-irradiated alcohol-hydrocarbon glasses. However, in PrOH-TMP-DMB, BuOH-TMP-DMB, and PnOH-TMP-DMB, this type of electron transfer was not observed and the e_{alc}^- formation was found to result only from the direct radiolysis of alcohols. In the alcohol concentration range lower than 0.2 electron fraction the yields of e_{alc}^- are less than those expected from the direct radiolysis of alcohols. The average number of alcohol molecules in a cluster in these systems is estimated to be four in the lower alcohol concentration range studied. The position of the absorption maxima for e_{alc}^- in these systems is constant within experimental uncertainties independent of alcohol concentration, which is consistent with the results of a semicontinuum model calculation. (38 refs.)

73347 A new treatment for the interpretation of radical decay in γ-irradiated polyethylene. P.Wuensche (Dept. of Phys., Karl Marx Univ., Leipzig, Germany), J.Limburg, H.-K.Roth.
J. Macromol. Sci. - Phys. (USA), vol.B22, no.2, p.169-83 (1983).
The decay of polymer radicals in γ-irradiated polyethylene as measured by EPR is discussed from the viewpoint of a continuous but not constant distribution over the activation free energy and of the kinetic constants. The possibility of determining this distribution from experimental results alone is shown. In addition, the new treatment enables the authors to obtain more clearly the various temperature regions in which radical decay takes place most rapidly, and this allows a distinction by EPR, for instance, even between several kinds of low-density polyethylene. (10 refs.)

73348 Photolysis of compounds with P-I and As-I bonds. T.L.Andreeva, G.N.Birich, V.N.Sorokin, I.I.Struk, D.N.Suvorov.
J. Sov. Laser Res. (USA), vol.4, no.1, p.31-45 (Jan.-Feb. 1983).
Detailed experimental investigations are reported of the parameters of lasing on the transition $^2P_{1/2} \rightarrow {}^2P_{3/2}$, $\lambda = 1.3$ μm of atomic iodine upon photodissociation of the molecules $(CF_3)_2AsI$ and $(CF_3)_2PI$. The light source was an IFP-5000 flash lamp. The experimental data are used to determine the sequence of the basic reactions that accompany the photolysis of the molecules $(CF_3)_2AsI$ and $(CF_3)_2PI$ and to determine the energy parameters of the generated radiation. (18 refs.)

73349 Photodissociation of the molecules $SiCl_3I$ and SiF_3I. T.L.Andreeva, V.N.Sorokin, I.I.Struk.
J. Sov. Laser Res. (USA), vol.4, no.1, p.46-55 (Jan.-Feb. 1983).
The parameters of lasing based on the transition of atomic iodine and occurring upon photodissociation of the molecules $SiCl_3I$ and SiF_3I are experimentally investigated. The light source employed was a coaxial xenon-filled flash lamp of original construction. The main chemical reactions that accompany the photolysis of the molecules $SiCl_3I$ and Sif_3I and determine the energy characteristics of the generated radiation are analyzed. (10 refs.)

73350 Possibility of lasing in the visible band by molecule photodissociation. T.L.Andreeva.
J. Sov. Laser Res. (USA), vol.4, no.1, p.56-64 (Jan.-Feb. 1983).
The lower excited states of certain diatomic radicals and atoms, transitions from which to the ground state lie in the visible and in the near ultraviolet regions of the spectrum, are analyzed. Possible mechanisms of inversion via photodissociation of the molecules by radiation from a source with a continuous spectrum, having a brightness temperature $T \approx 3 \times 10^4$K, are considered. (27 refs.)

73351 Reactions of excited $I^*(^2P_{1/2})$ and unexcited $I(^2P_{3/2})$ iodine atoms in perfluoroalkyl radicals. T.L.Andreeva, S.V.Kuznetsova, A.I.Maslov, I.I.Sobel'man.
J. Sov. Laser Res. (USA), vol.4, no.1, p.65-84 (Jan.-Feb. 1983).
A method of investigating reactions of excited and unexcited atoms is discussed. It is based on pulsed photolysis of molecules with simultaneous passage of laser radiation through the working medium. The method proposed is used to investigate the reactions that accompany the photolysis of the molecules $RI(CF_3I$, n-C_3F_7I, i-$C_3F_7I)$. The rate constants of the recombination of iodine atoms into I_2 in the presence of RI molecules are calculated for the atoms $I(^2P_{3/2})$ and $I^*(^2P_{1/2})$, as are the recombination constants of the radicals R into R_2 and with the atoms $I^*(^2P_{1/2})$ and $I(^2P_{3/2})$ into the RI molecule. It is shown that the $I(^2P_{3/2})$ atoms are much more active in the recombination into I_2 and RI than the $I^*(^2P_{1/2})$ atoms. The role of the investigated reactions in the kinetics of a photodissociation iodine laser (PDIL) is discussed. The results are compared with the published data. (43 refs.)

73352 Mechanism of hydrogen atom decay in γ-irradiated sulfuric acid glasses. A.Plonka (Max-Planck Inst. fur Strahlenchemie, Mulheim-am-Ruhr, Germany).
Radiat. Phys. & Chem. (GB), vol.21, no.4, p.405-9 (1983).
With the use of an X-band ESR spectrometer coupled with van de Graaff accelerator the decay kinetics of hydrogen atoms produced with apparent radiation yield 2.1-2.8 per 100 eV was followed at 88-113K in 6 M sulfuric acid glasses. The complex decay patterns were adequately described by the second order kinetic equation with time-dependent rate constant of the form $k(t) = Bt^{\alpha-1}$, where the constant α characterizes the variety of hydrogen atom localization sites and the temperature dependence of rate constant is contained in B. In the proposed reaction model the rate limiting step consists in the reorientation of water molecules to form the proper structure for translational movement of hydrogen atoms which are assumed to diffuse very slowly, with time-dependent diffusion coefficient, at low temperatures. The importance of reorientation of water molecules is evidenced by non-Arrhenius behaviour of B in the region of the first peak in the density of vibrational states of solid amorphous water at about 70 cm^{-1}. (18 refs.)

73353 Determination of quantum yield of metal particles to semiconductor in the SnI_2-Ag system. M.T.Kostyshin, V.S.Kostko, V.A.Dan'ko.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.455-7 (March 1983). In Russian.
Proposes a method of determining the quantum yield of metallic particles to a semiconductor in a semiconductor-metal system. The quantum yield of Ag in SnI_2 during irradiation of the system with monochromatic light at 450 nm was found to be 8%. (8 refs.) *V.G.P.*

Time-resolved resonance Raman study of transient benzooxazolinic merocyanines .... See Entry 70884

Influence of solvents on the relaxation times of polymethine dyes in the picosecond range .... See Entry 70958

Photodissociation and predissociation in strong electromagnetic field: distortion of the continuum .... See Entry 70965

Stability of semiconducting TiO_2 photoanodes .... See Entry 72444

A laser method of examining metal ignition kinetics .... See Entry 73335

Spectroscopic and electrochemical studies on ruthenium(II) complexes containing diazadiimine ligands .... See Entry 73383

The relation between performance and stability of Cd-chalcogenide/polysulfide photoelectrochemical cells. I. Model and the effect of photoetching .... See Entry 73465

82.50E Photodissociation, photoionization as studied by luminescence and radiationless transitions

73354 On the source of difluorocarbene in IRMPD of dichlorodifluoromethane. D.M.Rayner, S.Kimel, P.A.Hackett (Laser Chem. Group, Div. of Chem., Nat. Res. Council of Canada, Ottawa, Canada).
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.678-80 (29 April 1983).
The nascent translational energy of difluorocarbene produced in the IRMPD of CF_2Cl_2 has been measured by an optical time-of-flight technique. The energy decreases as the fluence of the infrared laser field increases. This is direct evidence for the secondary photolysis of the CF_2Cl radical in the overall mechanism. (18 refs.)

73355 Rotational excitation in the carbon monoxide product of ketene photodissociation. R.N.Rosenfeld, B.I.Sonobe (Dept. of Chem., Univ. of California, Davis, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.6, p.1661-2 (23 March 1983).
Reports the application of an infrared fluorescence method in probing rovibrational energy release to carbon monoxide, formed upon the photodissociation of ketene. The data are in qualitative accord with published data on the CO vibrational energy distribution for this chemistry but additionally demonstrate that rotational energy release is a dominant feature of the reaction dynamics. This result has important bearing on the problem of elucidating the nature of the potential surface for ketene photofragmentation. (17 refs.)

73356 Time-resolved resonance fluorescence studies of $O(^1D_2)$ yields in the photodissociation of O_3 at 248 and 308 nm. G.D.Greenblatt, J.R.Wiesenfeld (Dept. of Chem., Cornell Univ., Ithaca, NY, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4924-8 (15 April 1983).
The yield of electronically excited oxygen atoms $O(^1D_2)$ following excimer laser photolysis of ozone at 248 and 308 nm was directly measured using time-resolved resonance fluorescence emission at ≈130 nm. The result obtained at 248 nm is in good agreement with a previous resonance fluorescence measurement in which the yield of ground-state $O(^3P_J)$ was determined in the presence of gases which either quenched or reacted with $O(^1D_2)$. The relative yield determined at 308 nm 0.79 ± 0.02 is the first such determination in the region of weak Hartley band absorption near the thermochemical threshold for production of $O(^1D_2) + O_2(a^1\Delta_g)$. When taken in conjunction with the previously measured relative yields of $O(^1D_2)$ at this wavelength, this result suggests that the yield of electronically excited oxygen atoms at 300 nm is 0.96 ± 0.02. (23 refs.)

Orientation dependence in the reaction of Xe* with photodissociation polarized IBr .... See Entry 73327

82.60 CHEMICAL THERMODYNAMICS

(see also 05.70 Thermodynamics)

73357 Study of correlation effects in the calculation of heats of reactions. J.Breulet, J.Lievin (Service de Chimie Phys. Moleculaire, Univ. Libre de Bruxelles, Bruxelles, Belgium).

THEOCHEM (Netherlands), vol.10, p.341-5 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).

A simplified method of correlation energy calculation has been recently proposed. This method, which was shown to give good reaction heats where HF calculation fails (dissociations) is tested here in the calculation of reaction heats for which the HF approximation gives good results. (4 refs.)

73358 Standard free energy of formation of iron iodide. A.Khandkar, V.B.Tare, J.B.Wagner,Jr. (Center for Solid State Sci., Arizona State Univ., Tempe, AZ, USA).

J. Electrochem. Soc. (USA), vol.130, no.4, p.880-2 (April 1983).

By using silver iodide as a solid electrolyte it is possible to formulate a galvanic cell Ag|AgI|Fe-FeI_2 to determine the free energy of formation of iron iodide. The thermodynamic stability of FeI_2 is not known precisely, but it appears to be less stable than AgI. Thus if the cell satisfies the criteria for reversability, the open-circut EMF is related to the free energy change of the cell reaction by $\Delta G_{cell}=-nE\mathrm{F}=2\Delta G°_{AgI}-\Delta G°_{FeI2}$, where n is number of electrons transferred during the cell reaction, E the EMF in volts, and F the Faraday constant. The overall cell reaction is $2Ag+FeI_2=2AgI+Fe$. The standard free energy of formation of AgI is known and hence it is possible to estimate the standard free energy of formation of iron iodide by measuring the open-circuit EMF of the above cell as a function of temperature. (10 refs.)

73359 Thermodynamic properties of aqueous solutions of the alkali metal chlorides to 250°C. H.F.Holmes, R.E.Mesmer (Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).

J. Phys. Chem. (USA), vol.87, no.7, p.1242-55 (31 March 1983).

Osmotic coefficients of LiCl(aq), KCl(aq), and CsCl(aq) have been determined, at 225 and 250°C, by isopiestic comparison with NaCl(aq). Equilibrium molalities ranged up to 8 mol kg^{-1}. Isothermal osmotic data can be precisely described by the ion interaction model of Pitzer (1973). The osmotic, and activity, coefficients continue to decrease with increasing temperature with LiCl(aq) retaining a measure of individuality when compared to the other alkali metal chlorides. The authors' present results have been compared and combined with previously reported thermodynamic data (isopiestic and vapour pressure measurements, electrochemical cell potentials, freezing temperature determinations, enthalpies of solution and dilution, and heat capacities) within the framework of the ion interaction model. The resulting set of equations provides a thermodynamic description, essentially within the accuracy of the reported experimental results, of LiCl(aq), KCl(aq), and CsCl(aq) as a function of temperature (from 0 to 250°C) and molality (up to about 6 mol kg^{-1}). The ion interaction parameter $\beta^{(0)}$ was in the order $LiCl>NaCl>KCl>CsCl$ at all temperatures. The same trend was observed for the excess thermodynamic properties ϕ, γ, and ${}^{\phi}L$. Contributions of the short-range interactions to the activity coefficient ($\ln \gamma\text{-}f^{\gamma}$) are linearly related to the reciprocal radius of the cation. Excess free energy data for the alkali metal chlorides to 250°C can be modeled surprisingly well with a single parameter—the hard-core diameter—using the theoretical form of the ion interaction model. (77 refs.)

73360 Heterogeneous reactions and chemical transport of molybdenum with halogens and oxygen under steady state conditions of incandescent lamps. G.Dittmer, U.Niemann (Philips GmbH Forschungslab. Aachen, Aachen, Germany).

Mater. Res. Bull. (USA), vol.18, no.3, p.355-69 (March 1983).

Thermodynamic data of molybdenum chlorides and oxychlorides have been derived from transport measurements. A critical revision of literature data and an application of theoretical estime enable the authors to present a complete set of data for gaseous molybdenum halides, oxyhalides and oxides and for a selected number of liquid and solid compounds. (40 refs.)

Structure and energetics of [4.4.4.4.]fenestrane ....See Entry 70790

Solvation and conformation of methanol in water ....See Entry 70982

Heat of crystallization and melting point of amorphous silicon ....See Entry 72081

Enthalpy of solution of ammonium iodide in water ....See Entry 72122

Semiempirical theory of solid solubility in metallic alloys ....See Entry 72123

Thermodynamics of the $U_xPu_{1-x}O_{2-z}$ system in the liquid range ....See Entry 72137

Calorimetric studies of molecular layers of yellow arsenic ......See Entry 72284

Some solid-state properties of blends of polyethylene terephthalate and polyamide-6,6 ....See Entry 73206

Dissociation constants of amino acids in isopropanol+water mixtures ....See Entry 73324

Charge-transfer interactions with *N*-methylquinolinium ion as electron acceptor ....See Entry 73331

Equilibrium aggregation in a moderately concentrated finely dispersed system ....See Entry 73374

82.65 SURFACE PROCESSES

73361 Study of surface poisoning and regenerating on $LaNi_5$ by sulphides. Yu Shing-nan, zhang Ching-Zhe, Xie Kan, Kang Gin, Lin-Zhang-da (Inst. of Phys., Acad. Sinica, Beijing, China).

Acta Phys. Sin. (China), vol.32, no.3, p.360-5 (March 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*

This article is a brief summary of the authors' study on poisoning and regenerating at the surface of $LaNi_5$ by impurities, which are H_2S, SO_2 and CS_2 contained in the hydrogen used. The AES, XPS analyses show that the feature of the poisoning for three sulfides are different: $LaNi_5$ poisoned by H_2S produces the surface compounds, such as La_2S_3 and NiS. The chemisorption and physisorption occurred due to SO_2 and CS_2 poisoning respectively. In addition, surface catalytic property of active nickel on $LaNi_5$ can be shown by evaluation of the changes in the intensity of nickel peak in the Ni($2p_{3/2}$) spectrum. Pure hydrogen cycle method is effective for regeneration of $LaNi_5$ poisoned by SO_2 and CS_2, but this is not true for H_2S-poisoned samples. These results are very useful in explaining the mechanisms of rare earth intermetallic hydrides surface poisoning and regenerating. (4 refs.)

73362 Enhanced char reactivity via a tailored pore structure. G.A.Simons (Phys. Sci. Inc., Andover, MA, USA).

Combust. & Flame (USA), vol.50, no.3, p.275-85 (April 1983).

A single-particle char oxidation model is summarised and utilised to illuminate the role of the pore structure in char oxidation. The model describes the pore structure, mass transport, and the heterogeneous chemistry which occur during the oxidation of porous coal char. The pore structure is depicted as a collection of pore trees, with a continuous size distribution and branching sequence. Oxygen diffuses into the pore tree and consumes carbon from the walls of the pores. The basic heterogeneous rate constants have been inferred from existing laboratory data on nonporous carbon, and the oxidation model is validated with data on porous carbon char. The influence of the physical properties of char on its reactivity to oxygen have been quantitatively assessed. (29 refs.)

73363 Statistical rates for reactions on a heterogeneous surface. S.D.Prasad, L.K.Doraiswamy (Nat. Chem. Lab., Pune, India).

Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.31-6 (6 May 1983).

Using the random patch model, kinetic expressions are derived for the pressure dependence of first- and second-order surface reactions. Employing first- and second-order Stieltjes transforms and a Mellin transform, explicit expressions are derived for the rates as functions of pressure and the parameters characterizing the site energy distribution. It is shown that the rates reflect the nature of the four distributions studied. (13 refs.)

73364 Osmotic and activity coefficients of some pyridine complexes with halogenoacetic acids in benzene at 25°C. Z.Dega-Szafran, M.Szafran (Dept. of Chem., A. Mickiewicz Univ., Poznan, Poland).

J. Mol. Liq. (Netherlands), vol.25, no.2, p.109-13 (April 1983).

Osmotic coefficients measured by vapour pressure osmometry are reported for benzene solutions of complexes of pyridine with trifluoracetic, dichloroacetic and chloroacetic acids at 25°C. Solute activities decrease with increasing concentration due to formation of self-associates. It is suggested that dipole-dipole interactions contribute substantially to the stability of the associates. (5 refs.)

73365 Diffusional boundary layer resistance for membrane transport. M.P.Bohrer (Bell Labs., Murray Hill, NJ, USA).

Ind. & Eng. Chem., Fundam. (USA), vol.22, no.1, p.72-8 (Feb. 1983).

Diffusional fluxes across well-characterized membranes were measured for a variety of solutes in a stirred diffusion cell. The results were analyzed in terms of a diffusional boundary layer model based on transport through a membrane containing a uniform array of circular pores. Diffusional boundary layer resistances (R_b) were calculated from the measured fluxes and compared to values obtained using a polarographic technique and to values determined indirectly from the stirring speed dependence of the overall mass transfer resistance. The measured values of R_b were found to be strongly influenced by the membrane porosity, R_b for the lowest porosity (1.7%) membrane being twofold greater than R_b for membranes with porosities of 6.2 or 19.9%. (20 refs.)

73366 On models of interactive dynamical processes at surfaces. U.Landman (School of Phys., Georgia Inst. of Technol., Atlanta, GA, USA).

Isr. J. Chem. (Israel), vol.22, no.4, p.339-59 (1982).

One of the major objectives of surface science is the understanding of the fundamental processes involved in chemical reactions catalyzed by solid surfaces. A catalyzed surface reaction may conveniently be described by a sequence of elementary kinetic steps such as adsorption (which may proceed via stages involving precursor states, physisorption etc.); diffusion (on the surface and in certain cases through the bulk); reaction (dissociation, association, rearrangement etc.) and desorption. The traditional thermochemical analysis of reactions involving the balance of heats of the above distinct processes, such as heats of adsorption, desorption, dissociation and bond formation, provides criteria for the occurrence of certain reaction paths. However, such analysis, while determining the direction of the process in the reactants-products space, does not provide detailed information about the reaction rates and the fundamental microscopic processes which govern them. The employment of specific catalytic agents in a chemical reaction provides the means for modifying reaction paths and rates. In addition, through the use of the proper catalyst a particular reaction channel, selected from the manifold of thermodynamically allowed ones, may be enhanced. In order to enable one to choose specific catalysts with the objective of optimizing the yield of a desired reaction product it is necessary to develop an understanding of the microscopic interaction processes and to identify the physical parameters of the catalytic system (catalyst, reactants, and ambient conditions) which govern the outcome and rate of the reaction. (132 refs.)

73367 Studies of structure and dynamics in heterogeneous reactions. S.L.Bernasek (Dept. of Chem., Princeton Univ., Princeton, NJ, USA).

Isr. J. Chem. (Israel), vol.22, no.4, p.395-400 (1982).

The combination of methods from surface chemical physics with methods from studies of molecular reaction dynamics can provide a detailed understanding of the dynamics of heterogeneous reactions. Examples from work in the author's laboratory are used to illustrate this approach to the study of gas-solid reactions. (20 refs.)

73368 Oxygen permeable membrane for oxygen enriched combustion. S.Asakawa, Y.Saito, M.Kawahito, Y.Ito, S.Tsuchiya (Matsushita Res. Inst., Tokyo Inc., Tokyo, Japan), K.Sugata.

Natl. Tech. Rep. (Japan), vol.29, no.1, p.93-101 (Feb. 1983). In Japanese.

An oxygen enriched air production system using gas separation membranes has been developed to be used for fuel combustion systems. High oxygen permeable copolymers, including three dimensional structure have been synthesized through condensation of polyvinylphenol with some, α, ω-bis (diethylamino) polydimethylsiloxanes. The experimental results showed that the oxygen permeability through the copolymer varies as a function of the dimethylsiloxane content of the copolymers. Such composition dependence of the oxygen permeability was explained on the basis of polymer constitution. The copolymers are soluble in most common organic solvents and uniform, defect-free membranes as thin as 1000 Å have been formed by spreading solutions of the copolymer on water. Composite membranes fabricated by applying the membranes to porous support materials were used for practical gas separation and 30% oxygen enriched air was produced from ambient air. A new type oxygen enriched combustion system, which is more efficient for energy saving, has been developed by utilizing oxygen enriched air thus produced. (15 refs.)

73369 Adsorption and reactions of CO, NO, H_2 and O_2 on group VIII metal surfaces. B.E.Nieuwenhuys (Gorlaeus Lab., Rijksuniv. Leiden, Leiden, Netherlands).

Surf. Sci. (Netherlands), vol.126, no.1-3, p.307-36 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).

The adsorption of CO, NO, H_2, O_2, H_2O, CO_2 and N_2 is discussed in relation to the activity and selectivity of the various Group VIII metals in reactions of oxygen with hydrogen and carbon monoxide, nitric oxide with carbon monoxide and hydrogen, and carbon monoxide with hydrogen. (111 refs.)

73370 The reaction of sputtered FeTi with UHV residual gas studied by XPS. M.Polak, M.Hefetz, M.H.Mintz, M.P.Dariel (Ben-Gurion Univ. of the Negev, Beer Sheva, Israel).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.739-44 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
X-ray photoelectron spectroscopy (XPS) studies of polycrystalline FeTi surfaces under UHV conditions (2×10^{-10} Torr) revealed the presence of selective interactions between the titanium atoms at the ion-sputtered surface and H_2O molecules from the residual gas. Titanium oxide (TiO) becomes, during the exposure, the dominant surface species as inferred from the Ti($2p_{3/2}$) and O(1s) chemical shifts. The Fe(2p) spectrum characteristic of metallic iron hardly changed during the entire exposure. Sputter-induced structural defects at the FeTi surfaces are supposed to accelerate TiO nucleation. (12 refs.)

73371 Influence of aluminum adatoms on the germanium oxidation process. A.D.Katnani, P.Perfetti, Te-Xiu Zhao, G.Margaritondo (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Fifteenth Annual Synchrotron Radiation Users Group Conference (papers in summary form only received), Stoughton, WI, USA, 18-19 Oct. 1982 (Stoughton, WI, USA: Synchrotron Radiat. Center 1982), p.28
Ultrathin Al overlayers (0.4-2 Å) dramatically increase the oxidation rate of Ge(111) surfaces. The resulting initial chemisorption phase does not correspond to any of the known oxides of Ge or Al. A study of photoemission spectra of the core levels and of the valence band taken with synchrotron radiation gives information on the nature of this new phase. In particular, low oxygen exposures shift in energy the Al2p level while they do not affect the Ge3d level. However, neither the Al2p core-level spectra nor the valence-state spectra correspond to those of oxidized aluminum. For example, the chemical shifts of the Al2p level in oxidized Al and in the new phase are different by about 1.5 eV. Possible models will be discussed for the new phase which is likely to provide a stable interface between Ge and germanium dioxide. (no refs.)

Integral emittance of niobium during high-temperature heating and oxidation .... See Entry 72144

Multiphonon surface processes .... See Entry 72207

Anomalous sorption kinetics curves and Fick diffusion .... See Entry 72213

Partially dissociative adsorption of water vapor on the Si(111)(7×7) surface .... See Entry 72231

Temperature programmed field desorption of protonated hydrogen from rhodium and tungsten .... See Entry 72238

Physical interactions between molecules and supported catalysts .... See Entry 72461

Effects of underpotentially deposited Tl and Pb submonolayers on the surface-enhanced Raman scattering (SERS) from pyridine at Ag electrodes .... See Entry 72780

Ion induced surface alterations due to electronic charge exchange and chemical reactions .... See Entry 72915

Tribological properties of sintered polycrystalline and single-crystal silicon carbide .... See Entry 73218

In situ analysis of passive and transpassive films on nickel by modulated UV-visible reflection spectroscopy .... See Entry 73282

Nonresonant laser chemistry in the interaction of intense radiation with matter .... See Entry 73345

Thermodynamic properties of aqueous solutions of the alkali metal chlorides to 250°C .... See Entry 73359

The friction coefficient in deswelling gels .... See Entry 73373

Spectroscopic and electrochemical studies on ruthenium(II) complexes containing diazadiimine ligands .... See Entry 73383

^{252}Cf plasma desorption in ion implanted mica .... See Entry 73389

82.70 DISPERSE SYSTEMS

(for flow behaviour, see 47.55K)

73372 Small-angle neutron scattering from an oil-in-water microemulsion as a function of temperature. L.J.Magid (Dept. of Chem., Univ. of Tennessee, Knoxville, TN, USA), R.Triolo, R.M.Jones, J.S.Johnson,Jr..
Chem. Phys. Lett. (Netherlands), vol.96, no.6, p.669-73 (29 April 1983).
A multicomponent oil-in-water microemulsion containing CTAB ($C_{16}H_{33}NMe_3Br$), *n*-octane, 1-butanol, NaBr, and D_2O has been studied by small-angle neutron scattering at several temperatures. The size of the microemulsion droplets was found to be independent of temperature. Correlation lengths for the critical concentration fluctuations agree with those determined earlier by light scattering. (4 refs.)

73373 The friction coefficient in deswelling gels. A.M.Hecht (Lab. de Spectroscopie Optique, Univ. de Savoie, Chambery, France), E.Geissler.
Polym. Commun. (GB), vol.24, no.4, p.98-101 (April 1983).
Measurement of the swelling pressure of a polymer gel in uniaxial symmetry gives direct access to the longitudinal osmotic modulus M_{os}. For polyacrylamide-water gel, at concentrations $c<0.2$ g cm^{-3} such observations are in good agreement with a scaling model of the gel in which account is taken of the shear elasticity. The collective diffusion coefficient $D\text{-}M_{os}/f$, where f is the friction coefficient, has previously been found by Bastide and Candau (1982) to deviate strongly from the scaling prediction upon deswelling, on account of the different behaviours of the shear and the osmotic contributions to M_{os}. It is shown, from measurements of the uniaxial deswelling rates of the gels as a function of applied pressure, that f also deviates from scaling behaviour, for small variations in concentration, f varies as $c^{1.5}$, as predicted by scaling considerations, while for larger variations, f varies approximately as $c^{1.25}$. (19 refs.)

73374 Equilibrium aggregation in a moderately concentrated finely dispersed system. Yu.A.Buevich (A.M. Gor'kii Ural State Univ., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.2, p.913-19 (Aug. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.2, p.280-7 (Aug. 1982). [received: April 1983]
The equilibrium properties of dispersed small interacting particles capable of reversible aggregation are investigated. (12 refs.)

73375 Effect of sedimentation on Taylor diffusion. C.Van den Broeck, E.Dekempeneer (Vrije Univ. Brussel, Brussel, Belgium).
Phys. Rev. A (USA), vol.27, no.5, p.2727-30 (May 1983).
The authors calculate the effective longitudinal diffusion coefficient K of a Brownian particle suspended in a fluid of different specific weight (difference $\Delta\rho$), in laminar flow between two plane parallel plates (at a distance L). In the case of spherical particles (radius a), one finds a fast decrease of K due to sedimentation for values of a larger than the value a_M for which K reaches a maximum. Typically a_M is of the order of 10^{-5} cm. Its precise value depends on $\Delta\rho$, L, and the characteristics of the flow (Poiseuille or linear shear). The possible experimental verification is discussed. (6 refs.)

73376 Influence of thermal treatments on the structure and stability of gelatin gels. M.Djabourov, P.Papon (Lab. de Dispositifs Infrarouge et Phys. Thermique, Ecole de Phys. et Chimie, Paris, France).
Polymer (GB), vol.24, no.5, p.537-42 (May 1983).
The influence of thermal history on the structure of gelatin gels has been investigated by measuring the specific optical rotation $[\alpha]_\lambda$ at $\lambda=436$ nm. The helix content χ in the gels was derived by reference to the native collagen. Two types of thermal treatments have been applied: (a) cooling and heating at constant rates, and (b) quenching and annealing for long periods. The authors' results support the idea that the gels are nonequilibrium systems and exhibit thermal hysteresis. The kinetics of helix formation were analysed by the Avrami theory and compared to other techniques. The stability of the structures formed suggests the existence of several mechanisms of hydrogen bonding of the helices: disordered aggregation or partial collagen renaturation. (18 refs.)

73377 Studies on conductivity of nickel soaps in benzene-methanol mixtures. K.N.Mehrotra, R.Kachhwaha, S.C.Chopra (Dept. of Chem., Univ. of Jodhpur, Jodhpur, India).
Trans. SAEST (India), vol.17, no.4, p.307-13 (Oct.-Dec. 1982). [received: May 1983]
The conductometric measurements of solutions of nickel laurate in mixtures of benzene and methanol of varying composition have been used to determine the critical micelle concentration. The Debye-Huckel-Onsager-theory of electrolytic conductance is not applicable to the solutions of nickel laurate and the soap behaves as a weak electrolyte in solution. (6 refs.)

73378 The resolution times of water-in-oil emulsions subjected to external electric fields. T.J.Williams, A.G.Bailey (Dept. of Electrical Engng., Univ. of Southampton, Southampton, England).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.39-44
The application of an external electric field to a water-in-oil emulsion induces coalescence of the suspended water droplets. As the droplets grow their terminal speeds increase. In consequence, the resolution time of the emulsion, into its constituent phases, decreases in the presence of the electric field. The theoretical treatment models the emulsion droplets as monodisperse and cubically packed. The theoretical expression for emulsion resolution time agrees well with experimental data. (5 refs.)

73379 Current voltage characteristic of a cylindrical electrostatic precipitator. J.Cross (Div. of Fossil Fuels, CSIRO, North Ryde, NSW, Australia).
Electrostatics 1983. Sixth Conference on Electrostatic Phenomena, Oxford, England, 13-15 April 1983 (Bristol, England: IOP 1983), p.123-8
A cylindrical experimental electrostatic precipitator, which operates in conjunction with a pilot-scale furnace, was built to investigate the precipitability of fly ashes from different coals. The current-voltage characteristics of the precipitator have been investigated for a number of fly ashes with and without trace additives to aid precipitation. The curves obtained can be related to the behaviour of the ash and the conditions in the precipitator. (2 refs.)

Exact stationary solutions of kinetic equations describing particle coalescence .... See Entry 70019

Artefact peaks in particle size distributions measured by the electrical sensing zone (Coulter counter) method .... See Entry 70033

Kodacolor VR 1000 film .... See Entry 70131

One-dimensional acoustic wave propagation in a particulate suspension .... See Entry 71261

Thermal conductivity of colloidal capillary porous bodies in the process of structure formation .... See Entry 71344

Stabilization of bubble-liquid processes by an electric field .... See Entry 71659

Multidetector scattering as a probe of local structure in disordered phases .... See Entry 71864

Microstructure of semi-crystalline thermoplastics structural foams .... See Entry 71906

Diffusion-controlled deposition on fibers and surfaces .... See Entry 72285

Settling velocity distribution of natural aggregates .... See Entry 73787

82.80 CHEMICAL ANALYSIS AND RELATED PHYSICAL METHODS OF ANALYSIS

73380 Supersonic jets, rotational cooling, and analytical chemistry. J.M.Hayes, G.J.Small (Dept. of Chem., Iowa State Univ., Ames, IA, USA).
Anal. Chem. (USA), vol.55, no.4, p.565A-74 (April 1983).
Given a complex sample, such as shale oil or a biological specimen, is it too much to ask for a direct quantitative analysis that affords selectivity and sensitivity? The authors think not and hope that the article will allow the reader to share their optimism. To date the most widely used direct analysis technique for such samples has been capillary column/gas chromatography/mass spectroscopy (CC/GC/MS). A major problem is that 'dirty' samples cause rapid degradation of the capillary column. Thus, an extraction or prefractionation step frequently is used to clean up the sample prior to analysis. In addition, for isomeric species, CC/GC/MS must achieve chromatographic resolution to effect an analysis. In principle, electronic absorption or emission spectroscopy is the basis for one such detector. This is because electronic-vibrational (vibronic) transition energies and relative intensities are extremely sensitive to subtle changes in molecular structure. (13 refs.)

73381 Spectrophotometric determination of atmospheric nitrogen monoxide and nitrogen dioxide after collection with [*N,N′*-ethylenebis(salicylideniminato)]cobalt. K.Ishil, K.Aoki (Tokyo Metropolitan Res. Inst. for Environmental Protection, Tokyo, Japan).
Anal. Chem. (USA), vol.55, no.4, p.604-8 (April 1983).
A new method for sampling and determining NO and NO_2 in the atmosphere is investigated. Atmospheric NO and NO_2 are collected in a solution of [*N,N′*-ethylenebis(salicylideniminato)]cobalt (Co(salen)) in *o*-dichlorobenzene. NO reacts with Co(salen) reversibly yielding a nitrosyl complex (Co(salen)NO), which is converted to a nitro complex by air oxidation in the copresence of aminoethanethiol in an 83% yield. NO_2 is absorbed by

Co(salen) solution irreversibly. The product compound can easily be decomposed by stripping with aqueous alkaline solution, yielding the NO_2^- ion quantitatively. The nitro compound and the NO_2^- were quantified spectrophotometrically with a Griess-type reagent. In usual sampling conditions, O_3, NH_3, SO_2, CO, and H_2O did not interfere with the present method. The detection limits were 2 ppb.h (NO) and 1 ppb.h (NO_2). (20 refs.)

73382 Use of secondary ion emission for investigating the distribution profiles of elements and compounds in various film compositions. A.G.Koval, V.N.Mel'nikov, V.V.Bobkov, E.P.Biryukov, N.A.Kapralova (Kharkov State Univ., Kharkov, Ukrainian SSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.7, p.123-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.7, p.1346-51 (1982). [received: May 1983] (Proceedings of the XVIII All-Union Conference on Emission Electronics, Moscow, USSR, Dec. 1981).
The method of layer ion analysis is very promising for investigating thin films and transition zones of various solid-state electronic devices. The principal distinctive features of the method are the high degree of depth localization (~10 Å), very high sensitivity (up to 10^{-5}-10^{-7} wt.%), the possibility of determining the composition and distribution of chemical compounds in the system under consideration, and also the possibility of obtaining quantitative data on the distribution of elements and compounds in multicomponent systems. (10 refs.)

73383 Spectroscopic and electrochemical studies on ruthenium(II) complexes containing diazadiimine ligands. N.Kitamura, Y.Kawanishi, S.Tazuke (Res. Lab. of Resources Utilization, Tokyo Inst. of Technol., Yokohama, Japan).
Chem. Phys. Lett. (Netherlands), vol.97, no.1, p.103-6 (6 May 1983).
Newly prepared ruthenium(II) complexes, RuL_3, containing 3,3'-bipyridazine, 6,6'-dimethyl-4,4'-bipyrimidine, and 4-methyl-2-(2'-pyridyl)pyrimidine as ligands (L) were studied by absorption and emission spectroscopy as well as by cyclic voltammetry. The metal-to-ligand charge-transfer absorption spectra and the photocatalytic ability of these RuL_3 complexes were discussed on the basis of the redox properties of L and RuL_3. (12 refs.)

73384 Atmospheric pressure ion evaporation-mass spectrometry. J.V.Iribarne, P.J.Dziedzic (McLennan Phys. Labs., Univ. of Toronto, Toronto, Canada), B.A.Thomson.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.50, no.3, p.331-47 (15 May 1983).
The analytical possibilities of atmospheric pressure ion evaporation-mass spectrometry (APIE-MS) have been explored. The characteristics of the ion source have been studied. The method has been tested with a range of compounds and has been proven successful with most monovalent ions, both inorganic and organic; transition metals and most inorganic complexes are exceptions. The successful applications include alkaloids, amino acids, sulfonamides, vitamins and in general any compounds which contain a basic nitrogen atom or acidic groups. Certain neutral molecules also evaporate, clustered with ions. Calibration procedures for quantitative application have been developed. The relation of the intensity of mass peaks obtained with this source to molecular weight and structure and to surface activity, and the potential analytical value of the method are discussed. (13 refs.)

73385 In situ neutron activation analysis of and the neutron capture cross-section for $^{90}Sr^+$. L.A.McVey (Pacific Northwest Lab., Richland, WA, USA), R.L.Brodzinski, T.M.Tanner.
J. Radioanal. Chem. (Switzerland), vol.76, no.1, p.131-7 (1983).
Neutron activation analysis has been investigated as an in situ method for determination of ^{90}Sr. The thermal neutron capture cross-section for the $^{90}Sr(n,\gamma)^{91}Sr$ reaction has been measured to be 14.0 ± 2.4 mb which is in disagreement with the currently accepted literature value. The suitability of this reaction and the fast neutron reactions, $^{90}Sr(n,p)^{90}Rb$ and $^{90}Sr(n,\alpha)^{87}Kr$, for the in situ determination of ^{90}Sr is discussed. (5 refs.)

73386 Calculated gamma-ray and/or neutron attenuation coefficients in 14 MeV neutron activation analysis. A.G.Elayi (Dept. of Phys., Univ. of Baghdad, Baghdad, Iraq).
J. Radioanal. Chem. (Switzerland), vol.76, no.1, p.203-13 (1983).
A program of theoretical and experimental work was performed to develop a mathematical model which can represent all the parameters of the neutron activation analysis operation. Absolute techniques are avoided by using a sample containing the same element as the reference but having a different geometry and weight. This model is applied to determine the neutron, gamma-ray and neutron-and-gamma-ray self-shielding of the sample in relation with the number of counts in the total absorption peak. The results obtained should be applied within the limitations of the method. (9 refs.)

73387 Free-sulphur presence in steels. L.S.Caputi, G.Luzzi (Dipartimento di Fisica, Univ. della Calabria, Cosenza, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.1, p.5-8 (7 May 1983).
A new investigation technique, consisting in mechanically scraping sample surface and then performing Auger measurements in the zone, is described. Large S quantities are sometimes found in steels; this S presence seems to be due to free and mobile atoms, presumably coming from grain boundaries. (11 refs.)

73388 Normal and high pressure synthesis of mixed ruthenium-rhodium oxides of the rutile type. M.P.Herrero Fernandez, M.A.Alario Franco, J.C.Joubert (Inst. de Quimica Inorganica 'Elhuyar' CSIC, Madrid, Spain).
Mater. Res. Bull. (USA), vol.18, no.3, p.347-53 (March 1983).
A series of mixed ruthenium-rhodium oxides with general composition $Ru_{1-x}Rh_xO_y$ ($0<x<0.5$) has been prepared at normal and high pressures. The materials obtained at room pressure have a rutile structure and $y=2$. At 60 Kbar, an orthorhombic distortion of the rutile structure is observed for $0.3<x<0.4$. At the maximum distortion the unit cell parameters are $a=4.429(3)$ Å, $b=4.571(3)$ Å and $c=3.0972(9)$ Å. (13 refs.)

73389 ^{252}Cf plasma desorption in ion implanted mica. M.Maurette (Lab. Rene Bernas, Orsay, France), A.Banifatemi, S.Della-Negra.
Nature (GB), vol.303, no.5913, p.159-61 (12 May 1983).
^{252}Cf plasma-desorption mass spectrometry was first used to determine the masses of heavy molecules of biological interest. In this technique ^{252}Cf fission fragments penetrate a thin deposit of material (10^5 cm^{-2}) inducing the desorption of neutral and ionized species. The ionized species are accelerated by an external electrical field and their mass analysed using a time-of-flight (TOF) mass spectrometer run in the coincidence mode with each fission fragment. The authors have tried to assess the analytical and/or simulation potential of heavy-ion stimulated desorption of ions (HISD) in other fields ranging from the so-called 'gas-grain' interactions in astrophysics to the complex ageing of surfaces exposed to strongly ionizing environments in fast neutron fission reactors and fusion reactors. The authors outline the potential of HISD for investigating ion implantation effects in insulators and report a very strong enhancement in the HISD of ionized species from ion implanted mica. This enhancement, which generates heavy-ion clusters up to mass ~500 AMU, grows around a critical fluence of implanted ions, and originates from two distinct types of radiation damage defects. (9 refs.)

73390 Microanalysis for microelectronics. E.Fuchs (Siemens AG, Munchen, Germany).
NTG-Fachber. (Germany), vol.82, p.82 (1983). In German. (Grossintegration (Large Scale Integration), Baden-Baden, Germany, 7-9 March 1983).
For a region of about one micron diameter, the methods described are: an X-ray microprobe, an Auger electron microprobe, a secondary ion mass spectrometer and an electron microscope. The Auger electron technique is used to examine doping profiles. An example given for the implantation of boron in silicon quotes a graph of concentration versus depth. To obtain a pictorial image of a semiconductor component, grinding, polishing and etching have been carried out to enable the sample to be irradiated by 100-200 keV electrons and then examined over a thickness range of 10-100 nm by a transmission electron microscope. (no refs.) *G.C.*

73391 Determination of trace amounts of phosphate in river water by flow-injection analysis. S.Motomizu, T.Wakimoto, K.Toei (Dept. of Chem., Faculty of Sci., Okayama Univ., Okayama-shi, Japan).
Talanta (GB), vol.30, no.5, p.333-8 (May 1983).
A flow-injection analysis system for the determination of trace amounts of phosphate in river water has been developed. The phosphate is reacted with molybdate and Malachite Green in acidic medium to form a green species, the absorbance of which is measured at 650 nm. Phosphorus (as inorganic phosphate) can be determined at the level of several ng/ml in water. Analyses can be done at a rate of up to 40 per hour. (23 refs.)

73392 Spectrophotometric determination of micro amounts of nitrite in water and soil. Qian-feng Wu, Peng-fei Liu (Shaanxi Monitoring Station of Environmental Protection, Xian, China).
Talanta (GB), vol.30, no.5, p.374-6 (May 1983).
A spectrophotometric method for determination of micro amounts of nitrite in water and soil with *p*-aminoacetophenone and resorcinol is described. The interference of foreign ions can be eliminated by masking with complexing agents. Beer's law is obeyed up to 20 μg of NO_2^- in 60 ml of solution and the molar absorptivity at 435 nm is 5.27×10^4 $1.mole^{-1}.cm^{-1}$. The colour is stable for 10 hr. Results obtained by using the proposed method for water and soil samples agree well with those obtained by the Saltzman standard method. (11 refs.)

73393 Comments on accuracy in mass-spectrometric gas analysis. A.Breth, R.Dobrozemsky, B.Kraus (Phys. Dept., Austrian Res. Centre Seibersdorf, Seibersdorf, Austria).
Vacuum (GB), vol.33, no.1-2, p.73-6 (Jan.-Feb. 1983). (Proceedings of the 2nd Joint Meeting of the Roland Eotvos Physical Society (Vacuum Physics and Thin Films Sections) and the Austrian Vacuum Society, Brunn am Gebirge, Austria, 27-29 Oct. 1981).
Analysis of mass spectra from gases or gas mixtures has become a routine procedure in modern vacuum technology. The interpretation of these spectra, however, is straightforward only in very simple cases. In practical work, especially if oxygen-bearing gases dominate the spectrum, the defolding of peaks at interfering mass numbers turns out to be difficult, even if the cracking patterns are known precisely and do not change during the measurement. Changes in the cracking patterns may be caused by reactions at the hot filament, by sorption processes, by ESD, etc. Although the basic aspects of these disturbances are fairly well known, there is little knowledge about their influence on the accuracy of the calculated gas composition. In this contribution the authors give a discussion of experimental results (achieved with a commercial RGA) concerning the influence of disturbing effects on the calculated gas composition, with special emphasis on mixtures of CO and CO_2. (6 refs.)

Laser processing and analysis of materials .... See Entry 69807

Picosecond streak camera fluorometry. A review .... See Entry 70117

Statistical estimates of spectroscopic parameters in multichannel detection of weak optical spectra .... See Entry 70123

A new approach to infrared spectroscopy .... See Entry 70127

Operational features resulting in mass spectrometers from NPM-0.1 vapor-jet vacuum pumps .... See Entry 70139

Ion source of ROMS-2 mass spectrometer with fragmentless ionization .... See Entry 70141

Use of an X-ray diffractometer to investigate fluorescence radiation .... See Entry 70162

Ionic conductivity of amorphous mNaF-nMF$_3$ thin films (M=Al, Cr) .... See Entry 72162

An ESD and SIMS study of the composition of platinized, antimony-doped tin oxide films. I .... See Entry 72255

Plasmon excitation in Al-Mg surfaces .... See Entry 72467

Blue sputtered iridium oxide films (blue SIROFs) .... See Entry 72988

The effect of some additives on electroless copper deposition ..See Entry 73007

Pyrolysis products in ion/molecule reactions. II. Amines, thiols, and esters .... See Entry 73321

A study of the collision-induced dissociation of $C_2H_5OH_2^+$ using various target gases .... See Entry 73322

The angular distribution of fragment ions produced from polyatomic ion collisions .... See Entry 73323

The reaction of sputtered FeTi with UHV residual gas studied by XPS .... See Entry 73370

In vivo nitrogen analysis using ^{241}Am-Be neutrons—a feasibility study for a mobile facility .... See Entry 73661

86.00 ENERGY RESEARCH AND ENVIRONMENTAL SCIENCE

86.10 ENERGY RESOURCES AND THEIR UTILISATION

(inc. economic aspects; for nuclear engineering and nuclear power studies, see 28.00)

86.10B Fossil and other fuels

73394 Precious granules—source of energy and reducing agent. D.Bocker, M.Erken, J.Heuter, H.Kreusing (Rheinische Braunkohlenwerke AG, Koln, Germany).
Energie (Germany), vol.35, no.3, p.35-7 (March 1983). In German.
The paper provides an overall description of a plant for coking lignite. The plant was constructed by Lurgi under licence from Salem Corporation, USA. Waste gases and heat are utilised in the plant's energy requirements, resulting in an 'energy efficient' and 'environment friendly' coking process. The larger, second part of the paper deals with the properties and usage of the coke. Besides being a fuel, it is also used in chemical processes, in metallurgy, filters and electrodes. Current production of 110000 t pa is to be more than doubled by a second plant in 1985. (6 refs.) *P.R.S.*

73395 An economic flame—new methods of burning dust in industrial processes. U.Wiedmann (Korting Hannover AG, Hannover, Germany).
Energie (Germany), vol.35, no.3, p.39-41 (March 1983). In German.
The author describes his company's new CirCal dual fuel firing system for 0.5 to 2.0 MW outputs. The burners use a mixture of coal dust with 5-10% of oil or gas or alternatively lignite or wood dust with an optional addition of up to 5% of oil or gas. Changing of fuel is accomplished without interruption as are remotely controlled flame characteristics/temperature changes. Several systems are already installed and have proved to be successful. The return on investments in changing to these burners, can be less than a year at current fuel costs. (7 refs.) *P.R.S.*

73396 Design of a liquid fuels supply model for US policy analysis. J.Barhen, R.G.Alsmiller,Jr., C.R.Weisbin (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), F.Morra, V.A.Kuuskraa, D.M.Nesbitt, R.L.Phillips.
Energy (GB), vol.8, no.3, p.169-97 (March 1983).
The purpose of the paper is to call attention to the existence of this important new analytical tool, to provide a potential analyst with a reasonably complete description of its essential features, and to discuss the benchmarking completed and underway. Detailed network diagrams, process equations, and sources of data are given. Twelve depletable resource processes are represented. These include in situ and surface retorting of western oil shale, tar sands, western and eastern conventional onshore production, three types of enhanced oil recovery, eastern and western offshore recovery, and Alaskan onshore and offshore production. Details of the LFS model equations used to determine the equilibrium prices and quantities of liquid fuels are included. The fundamental data parameters which provide the computational basis for each supply technology are calculated from technology specific relationships between marginal cost and supply. LFS results are compared to projections of the National Energy Policy Plan. It is found that the LFS results generally fall within stated NEPP uncertainty ranges. A comprehensive sensitivity analysis capability, developed in conjunction with the LFS formulation, has been indispensible in identifying the differences in the calculated results. (60 refs.)

73397 Policies to reduce OEDC vulnerability to oil-supply disruptions. D.M.Kline, J.P.Weyant (Terman Engng. Center, Stanford Univ., Stanford, CA, USA).
Energy (GB), vol.8, no.3, p.199-211 (March 1983).
A number of proposals for reducing the level of exposure of the oil importing countries to oil supply interruptions are reviewed and contrasted. Although none of these options is without cost or complication, several appear to offer significant benefits relative to the status quo. Now is the time to fill the current void in energy emergency planning. (13 refs.)

73398 The Alaskan gas pipeline conflict. P.Savich, K.W.Hipel, N.M.Fraser (Dept. of Systems Design Engng., Univ. of Waterloo, Waterloo, Ontario, Canada).
Energy (GB), vol.8, no.3, p.213-24 (March 1983).
A new conflict analysis technique is employed to study the dispute surrounding the selection of a natural gas pipeline route to transport gas from the American state of Alaska and also northern Canada to southern markets in the United States and Canada. The improved metagame analysis algorithm is the type of conflict analysis method that is used for providing a framework to study systematically the Alaskan gas pipeline controversy and to put the historical information into proper perspective. In addition, the methodology is utilized for predicting the possible feasible political solutions to the conflict. (41 refs.)

73399 On gasohol and energy analysis. M.A.Johnson (Res. & Dev. Div., British Gas Corp., London, England).
Energy (GB), vol.8, no.3, p.225-33 (March 1983).
Energy analysis contributed to the public debate on the gasohol programme in the US, where this analysis became a legal requirement. The published energy analyses for gasohol are reviewed and we assess their inherent assumptions and data sources. The analyses are normalised to SI units to facilitate comparisons. The process of rationalising the various treatments uncovered areas of uncertainties, particularly in the methodologies which could be used to analyse some parts of the process. Although the definitive study has still to be written, the consensus is that maize to fuel ethanol via the traditional fermentation route is a net consumer of energy. (13 refs.)

73400 Hydrogen as a fuel. J.S.Wallace, C.A.Ward (Dept. of Mech. Engng., Univ. of Toronto, Toronto, Ontario, Canada).
Int. J. Hydrogen Energy (GB), vol.8, no.4, p.255-68 (1983).
Hydrogen, used as fuel, has a number of attractive features that make it a leading candidate in the search for an alternative to the dwindling and progressively less reliable supply of fluid hydrocarbon fuels. Hydrogen produced by electrolysis using hydro-or nuclear-generated electricity will be available in Canada at prices competitive with other portable forms of energy before the end of the century. The paper examines the use of carbon-free electrolytic hydrogen as a motor vehicle fuel and as a fuel for fuel cells. A review of onboard hydrogen storage systems indicates that the propulsion power unit of hydrogen-fueled vehicles must be considerably more efficient than present gasoline-fueled internal combustion engines in order to compensate for the larger size and greater weight of hydrogen storage systems. Hydrogen-fueled internal combustion engines are more efficient than similar gasoline-fueled engines, but the improvement is not sufficient to offset the storage system limitation. Fuel cells operate with much higher efficiency than internal combustion engines, especially at partial loads. A comparison between H_3PO_4 and KOH fuel cells show that where carbon-free hydrogen is available from the onboard storage system, the KOH fuel cell offers the higher level of performance. (43 refs.)

CANDU with hydrogen ....See Entry 70722
Coal gasification using solar energy ....See Entry 73466
Solar gasification of carbonaceous materials ....See Entry 73467
Energy systems in modular construction ....See Entry 73468
The effect of glucose concentration and pH on hydrogen production by Rhodopseudomonas sphaeroides VM 81 ....See Entry 73484
The hydrogen economy: future policy implications ....See Entry 73486

86.10D Wind energy

73401 An analysis of wind power potential in Greece. D.P.Lalas, H.Tselepidaki, G.Theoharatos (Dept. of Meteorology, Univ. of Athens, Athens, Greece).
Sol. Energy (USA), vol.30, no.6, p.497-505 (1983).
An analysis of the available wind data for the Aegean Sea region of Greece is carried out to ascertain its potential for wind energy development. The effect of the limited number of daily observations available on the accuracy of the mean wind speed and annual wind energy estimates is ascertained. The applicability of the Weibull distribution is then examined and plots of the Weibull parameters are given. The annual average wind energy flux is calculated and found to be quite high (in excess of 600 W/m^2 per yr at 10 m) which makes the Aegean Islands likely candidates for wind power utilization. (24 refs.)

86.10F Tidal and flow energy

(inc. water-wave energy)

73402 Hydropowerplants as a rationalisation element in the Czechoslovak power and fuel balance. L.Tekel.
Bull. EGU (Czechoslovakia), no.90, p.20-9 (1982). In Czech.
Discusses the possibilities for a hydropower contribution to the fuel and power balance of Czechoslovakia. (16 refs.)

73403 Change in the ice and thermal regime of the Vilyui river in the lower pool of the Vilyui I-II hydrostation. S.N.Nazarenko, N.B.Sakharova.
Hydrotech. Constr. (USA), vol.16, no.8, p.431-5 (Aug. 1982). Translation of: *Gidrotekh. Stroit. (USSR)*, vol.16, no.8, p.23-6 (Aug. 1982). [received: March 1983]
Shows that the effect of the hydrostation on various characteristics of the winter regime of the river extends over a considerable distance. The increase of the winter levels is traced on a stretch more than 1000 km long, i.e. practically to the mouth. A noticeable decrease of the water temperature in the summer months is observed on a stretch up to 800 km long, and an increase of temperature in the spring and fall months in a stretch 600 km long. Disturbances of the ice regime of the river (a shift of the times of freezeup and breakup) do not extend farther than 400 km, in which case migration of the ice edge occurs in the 35-60-km stretch closest to the hydrostation and the formation of secondary polynyas in the ice cover is noted on rapid stretches at a distance up to 200 km. Consideration of the changes in the natural ice and thermal regime of the river under the effect of activity of a hydrostation is necessary. (1 ref.)

73404 Optimization of the filling and drawdown regimes of a regulating reservoir of the Kuban' cascade. A.F.Fedosyuk, I.L.Krasnik, A.B.Kaganovich.
Hydrotech. Constr. (USA), vol.16, no.8, p.470-4 (Aug. 1982). Translation of: *Gidrotekh. Stroit. (USSR)*, vol.16, no.8, p.50-3 (Aug. 1982). [received: March 1983]
Optimizing the filling of the Great regulating reservoir makes it possible to increase the efficiency of using the flood, which provides additional production of electric energy. Optimization of the discharges along the Great Stavropol' Canal on the basis of the criterion of minimum specific discharges of hydrostations of the cascade and approximation of the regime of the hydrostations to these conditions additionally increase the effectiveness of using the stream. (2 refs.)

73405 Influence of conception development for energy use of mid and low course of Neretva on the design of hydro plant 'Mostar'. M.Pavlovic, S.Radovic.
Elektroprivreda (Yugoslavia), vol.36, no.1-2, p.17-27 (Jan.-Feb. 1983). In Croatian.
Presents the conception development for energy use of water belonging to mid and low course of Neretva for the period from 1953, when the first basic design was developed, until present days when the solutions have been adapted to meet the requirements for variable energy from one side, and the requirements of other potential users of water and space, from the other side. (13 refs.)

73406 An experimental study on the wave-power energy conversion. S.Miyae, Y.Teguri (Kanazawa Univ., Kanazawa, Japan).
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.87-94 (Nov. 1982). In Japanese.
Reports an experimental study on the wave-power energy conversion system depending on the wave-overtopping. This system consists of a converging wave channel, an overrunning slope and an elevated storage basin. The density of wave-power is amplified by the converging channel. Then the wave was elevated to the storage basin by the overrunning slope. The water in the storage basin discharged back to sea level via a low-head turbine driving a generator. The authors carried out an experiment on this system by using a regular wave, and as a result the optimum shape of the overrunning slope and the converging bank was obtained. (8 refs.)

86.10H Geothermal energy

73407 Forty years of electric-power development in Kenya. M.Kansara, N.S.Walkade (Dept. of Electrical Engng., Univ. of Nairobi, Nairobi, Kenya).
Energy (GB), vol.8, no.4, p.317-21 (April 1983).
The power system in Kenya has grown from a series of small isolated stations serving limited areas to one comprising a large power grid. The total installed capacity has increased from 10,314 kWe in 1938 to 102214 kWe at the time of independence in 1963. It has 460100 in 1978, while projected supply and demand for electricity in the year 2000 are anticipated to be 1,100,000 and 1,267,000 kWe respectively, thus showing a deficit of 167000 kWe,. (4 refs.)

73408 Faisabilite technique et economique de la geothermie basse energie en Europe (Technical and economic feasibility of deep geothermal energy in Europe. Annexes).
Report EUR 8241/II FR, Comm. European Communities, Luxembourg (1982), 343 pp. In French. Contract 640-78 EGF.
The report is a very comprehensive one, published by the Commission of the European Communities. It is split into some fourteen main sections. These include the determination of the hydrogeological and geothermal characteristics, the definitions of the provisional technical programmes and those of boring and piping. It reviews climatic conditions in relation to the covering of requirements by geothermal sources and deals with heat exchangers, heat pumps, costs and the transport of geothermal type water. Examples are given of the uses of heat in industry and adoption to the use of geothermally based energy. Examples are malt plants, breweries, milk installations, tanneries and mining industries. Details are given of existing geothermal installations, conditions in Italy and France and some recommendations are finally given.

Theory of the development of geothermal systems charged by vertical faults ....See Entry 73846

On fluid reserves and the production of superheated steam from fractured, vapor-dominated geothermal reservoirs ....See Entry 73847

86.10K Solar energy

73409 Utilization of solar energy in people's economy. S.Keresztes.
Energ. & Atomtech. (Hungary), vol.36, no.2, p.68-71 (Feb. 1983). In Hungarian.
In the plans for research and development of foreign countries, the activity connected with solar energy gets a role of larger and larger stress. Although this work has been carried out in some countries for more than 20 years, it has only been pointed out really by the increase in the problems of oil crisis and environmental pollution. In very many countries a stately organized and financed solar energy research is carried out. In spite of the widespread opinions, solar energy utilization in Hungary can be carried out economically by means of correspondingly differentiated approach. The exploitation of these possibilities is in the interest of people's economy. The Hungarian industry is able to produce equipments corresponding to the current situation of solar techniques, a large part of which can be produced expediently of aluminium. (2 refs.)

73410 High temperature solar electrothermal processing—zinc from zinc oxide. E.A.Fletcher, J.E.Noring (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Energy (GB), vol.8, no.4, p.247-54 (April 1983).
The authors examine the feasibility of using sunlight to reduce the amount of electric power and/or fossil fuel needed to win metals from their ores and other compounds. The uniqueness of highly concentrated sunlight as a source of high-temperature process heat makes it attractive. They also examine, in some detail, ZnO as a candidate substance for exploratory experimental studies. They have mapped out, in temperature-pressure coordinates, the properties of the working substance and the thermodynamic performance of an archetype device as a guide to the temperature-pressure regime in which experimental studies might most profitably be undertaken. (14 refs.)

73411 The solar radiation resource. A.Rabl, F.von Hippel (Center for Energy & Environmental Studies, Princeton Univ., Princeton, NJ, USA).
Energy (GB), vol.8, no.4, p.295-316 (April 1983).
The authors discuss the characteristics of solar radiation which are most useful for the assessment of solar technologies. Graphs are presented which show the total annual insolation incident on the principal tracking and non-tracking collectors. Additional graphs are developed for the latitudinal and seasonal variations of solar radiation in the absence of an atmosphere. These are then compared with measurements averaged over the US SOLMET sites to provide an understanding of the role of atmospheric effects on the seasonal variations of solar radiation. (15 refs.)

73412 Problems and prospects of solar power stations. K.Kotarska, Z.Kotarski.
Przegl. Elektrotech. (Poland), vol.58, no.11-12, p.345-50 (Nov.-Dec. 1982). In Polish.
World-wide development in the field of conversion of solar energy into electrical energy is presented. Solar power stations both with centralized and decentralized conversion are described. The present state and prospects of solar cell power stations on the Earth and in outer space with direct conversion of solar into electrical energy, are reviewed. (13 refs.)

73413 Preliminary research in the measurement of the solar radiation by transient technique. S.X.Cheng, X.S.Ge (Dept. of Modern Mech., Univ. of Sci. & Technol. of China, Hefei, China).
Sol. Energy (USA), vol.30, no.5, p.391-5 (1983).
A new technique for measuring the solar radiation is presented. It consists of measuring the heating and cooling rate of the sensor of the instruments when the sensor is exposed to or shielded from the incident solar radiation. The experimental apparatus are described in the paper along with the theoretical analyses of the technique. Solar radiation data using the apparatus are compared with those obtained through other means. The agreement is good. (8 refs.)

73414 Climatic predispositions of Yugoslavia for solar energy application. U.V.Desnica, N.B.Urli, B.Pivac (Rudjer Boskovic Inst., Zagreb, Yugoslavia).
Sol. Energy (USA), vol.30, no.5, p.401-12 (1983).
The paper is a summary report of an extended investigation of the practical usability of solar energy in Yugoslavia. The main tool for calculation was TRNSYS simulation program. Meteorological data and technical parameters of typical commercial solar devices were used as input data. Solar flux data on tilted planes were obtained by means of the Liu and Jordan method. For five locations, chosen to characterize all typical climatic regions in Yugoslavia, a detailed hour by hour simulation of the performance of the typical commercial domestic hot water solar heating system (DHW) was carried out. In summer the efficiency of such a device was similar for all locations, ranging from 40 to 45 per cent. In the winter months the efficiency varied from 30 per cent in sunny coastal regions to less than 10 per cent in polluted urban areas. The same type of calculations were worked out for a combined solar-traditional space-heating system, including the investigation of the influence of some important parameters on the efficiency of the solar part of the system. Calculations show that in very polluted urban areas only low-temperature load heat exchangers are to be recommended; in the coastal and southern parts of the country, however, high working temperature (50°C) is allowed which results in the average efficiency of the system of more than 25 per cent even if the worst month and even if the ordinary black-paint, double glazed collectors are used. (7 refs.)

73415 Digital data gathering for solar energy measurement. P.J.Hession, W.J.Bonwick (Dept. of Electrical Engng., Monash Univ., Clayton, Victoria, Australia).
Sol. Energy (USA), vol.30, no.5, p.441-6 (1983).
A new and inexpensive instrument is described which monitors, integrates and records the millivolt output of solar radiation meters and the design principles are given. Readouts are provided which indicate the instantaneous solar power, the running energy total and also the energy available over completed 1 hr, 1 day and 1 week intervals. The instrument has been in operation for over 12 months in Victoria, Australia and a set of weekly readings for this period is given. The accuracy of the recorded data is limited predominantly by the solar radiation meter itself. (5 refs.)

73416 Diffuse and global solar spectral irradiance under cloudless skies. D.T.Brine, M.Iqbal (Dept. of Mech. Engng., Univ. of British Columbia, Vancouver, Canada).
Sol. Energy (USA), vol.30, no.5, p.447-53 (1983).
A simple empirical model to calculate solar spectral diffuse and global irradiance under cloudless skies is presented. This formulation takes into account absorption of radiation by molecules such as O_3, H_2O and the uniformly-mixed gases. Attenuation by Rayleigh scattering and aerosol extinction are included. Aerosol attenuation is calculated through Angstrom's turbidity parameters α and β. The diffuse radiation is assumed to be composed of three parts: (1) Rayleigh-scattered diffuse irradiance; (2) aerosol-scattered diffuse irradiance; and (3) irradiance arising out of multiple reflections between the atmosphere and the ground. The global irradiance is the sum of these three components of diffuse irradiance plus the direct irradiance. The input parameters include an extraterrestrial spectrum, zenith angle, turbidity coefficient β, wavelength exponent α, ground albedo ρ_g, water vapor content and ozone content. The model is shown to yield very good results up to air mass two when compared to accurate theoretical calculations. No comparisons with measured spectra are presented because of a lack of accurate specifications of input parameters. Results are presented to show the effect of variation of certain of the input parameters. (26 refs.)

73417 Ideal second stages in tandem with spherical mirrors. E.M.Kritchman (Enrico Fermi Inst., Univ. of Chicago, Chicago, IL, USA).
Sol. Energy (USA), vol.30, no.5, p.481-2 (1983).
When focused by a spherical mirror, the image of the sun is substantially wider than when focused by a paraboloid mirror. Yet, the importance of spherical mirrors as means to concentrate solar energy, may be emphasized by their potential low cost, e.g. when fabricated from inflated aluminized mylar. In addition their low concentration capability may be improved by the introduction of second stage elements at their focal plane. Formulae that describe the concentration C_1 of the (primary) spherical concentrator are derived here and compared to the concentration capability C of the combined two stage concentrator, along with some computed data. (8 refs.)

73418 An experimental parabolic cylindrical concentrator: its construction and thermal performance. R.V.Heiti, G.Thodos (Northwestern Univ., Evanston, IL, USA).
Sol. Energy (USA), vol.30, no.5, p.483-5 (1983).
The construction, operation and thermal performance of a parabolic cylindrical solar energy concentrator is considered. The materials used in construction and their reasons for being used are pointed out and the operational procedure, modes of operation and efficiency obtained is discussed. (no refs.)

73419 Comments on paper [simple multiple wick solar still: analysis and performance]. P.Gandhidasan (Univ. of the West Indies, Faculty of Engng., St. Augustine, Trinidad).
Sol. Energy (USA), vol.30, no.5, p.492 (1983).
Presents the comments of P. Gandhidasan on the paper 'simple multiple wick solar still: analysis and performance' by Sodha et al. and also the reply from M.S. Sodha. The part of the paper under discussion is the equation dealing with convective heat transfer from water to glass. (no refs.)

73420 Solar flux distributions from circular cyclindrical concentrators. J.K.Sharma, A.Dang, H.P.Garg, S.S.Mathur (Center of Energy Studies, Indian Inst. of Technol., New Delhi, India).
Sol. Energy (USA), vol.30, no.6, p.507-12 (1983).
Solar flux distributions produced by circular cylindrical concentrators have been determined. An integral relationship for evaluating the energy density distribution on receivers of arbitrary shape has been developed. The solar intensity distributions have been calculated for flat and cylindrical receivers. The developed formulae are applied to uniform and non-uniform source intensity distributions. The effect of longitudinal defocusing on the intensity distributions on receivers has also been considered. In case of cylindrical receivers, the local concentration decreases with an increase in the radius of receiver as well as with rim angle β of the receiver. (13 refs.)

73421 The design and performance of ideal solar concentrators based on the prism-assisted cyclindrical reflector. I.R.Edmonds, I.R.Cowling, L.A.Meara, B.Wheeler (Dept. of Phys., Queensland Inst. of Technol., Brisbane, Australia).
Sol. Energy (USA), vol.30, no.6, p.537-43 (1983).
The optical design of an ideal concentrator based on the combination of a cylindrical reflector and refracting prism is discussed and shown to have a number of advantages over other reflector type concentrators. A 20× photovoltaic concentrator is shown to have an optical efficiency of over 70 per cent within the ideal acceptance angle in good agreement with experimental results. (9 refs.)

73422 Terrestrial solar spectral data sets. R.E.Bird, R.L.Hulstrom (Solar Energy Res. Inst., Golden, CO, USA), L.J.Lewis.
Sol. Energy (USA), vol.30, no.6, p.563-73 (1983).
Two data sets are presented that were generated with a rigorous radiative transfer code. One data set is an AM1.5 direct normal spectrum, and the other data set is an AM1.5 global spectrum on a surface tilted 37° from the horizontal towards the Sun. These data are updates to data that are nearing acceptance as standard of the American Society of Testing and Materials. An improved extraterrestrial spectrum and other refinements were made to improve the accuracy of these data sets. A preliminary comparison between modeled and measured data is shown, which supports the accuracy of the data sets. (24 refs.)

73423 Optical properties of compound elastical concentrators. P.G.McCormick (Dept. of Mech. Engng., Univ. of Western Australia, Nedlands, WA, Australia).
Sol. Energy (USA), vol.30, no.6, p.597-9 (1983).
Non-imaging concentrators have received considerable attention in recent years as a result of their ability to accept radiation over a range of incident angles. Ideal cylindrical concentrators, such as the compound parabolic concentrator (CPC), exhibit the highest possible concentration ratio for a given acceptance angle. It has been shown that simple elastic bending can be used to form the reflector profile for a non-imaging concentrator. For low concentration ratios, i.e. 1.5-3.0, the optical properties of optimised concentrators

with flat or cavity absorbers approach that of truncated CPC concentrators. (13 refs.)

73424 Stationary nonimaging concentrator as a second stage element in tracking systems. E.M.Kritchman, K.A.Snail, J.O'Gallagher, R.Winston (Enrico Fermi Inst., Univ. of Chicago, Chicago, IL, USA).
Sol. Energy (USA), vol.30, no.6, p.601-2 (1983).
The University of Chicago solar energy group and GTE Research Laboratories in Waltham, Massachusetts, have recently developed an integrated stationary evacuated concentrating (ISEC) collector tube (see ibid., vol.29, p.575, 1982). It consists of an extended cusp type compound parabolic concentrator (CPC) matched to a tubular selective absorber with the CPC and the absorber integrated into a vacuum enclosure. The outer wall of the enclosure is made by shaping a circular glass tube; the lower cross section of the glass conforms to a CPC profile and is coated with a reflective film, while the upper cross section of the glass is of a circular profile and acts like a transparent entrance window. The vacuum environment inside the enclosure enables the use of a highly reflective front surface silver mirror, increases the lifetime of the selective absorber coating, and minimizes heat loss from conduction and convection. The authors examine the increase in concentration of line focus concentrators that can be achieved by using the evacuated CPC collector tube as a second stage element. (16 refs.)

73425 Etude de faisabilite d'une centrale photovoltaique de taille moyenne (0,5 - 1 MW), avec stockage (Feasibility study for a medium-sized (0.5 - 1.0 MW) photovoltaic power station, with storage).
Report EUR 8196 FR, Comm. European Communities, Luxembourg (1982), 276 pp. In French. Contract 474-78-4 ESF.
The report covers a study between April 1978 and March 1979 at Bois d'Avey, France. The introduction covers the structure of the system, the carrying out of the work and also work subdivision. The first phase is then described, covering generators, identification and also the evaluation of subsystems. The second phase covers the choice of the best solutions for the larger options of the study. These include astronomical, meteorological, economic and energy storage aspects. The third phase of the report deals with general engineering matters concerning the power station. Some details on dimensioning are given, followed by optimisation generally of storage, series-parallel working, DC/AC conversion and general architecture.

73426 Utility interface issues for grid-connected photovoltaic systems. D.Chu, T.Key (Sandia Nat. Lab., Albuquerque, NM, USA), J.Fitzer.
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.391-5
Photovoltaic (PV) balance-of-system research and development has focused on interconnection with the utility grid as the most promising future application for photovoltaic energy production. These systems must be compatible with the existing utility grid to be accepted. Compatibility encompasses many technical, economic and institutional issues from lineman safety to revenue metering and power quality. The authors review DOE/PV sponsored research for two of the technical interconnection issues: harmonic injection, and power factor control. Explanations and rationale behind these two issues are reviewed, and the status of current research and plans for required future work presented. (12 refs.)

73427 AC power quality improvement for line-commutated inverters in photovoltaic applications. A.W.Pautzke (Windworks Inc., Mukwonago, WI, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.396-9
Line-Commutated Inverter (LCI) technology provides reliable, efficient and cost-effective DC to AC power conversion for photovoltaic systems. It's only potential shortcoming for large scale use was power quality. In 1980 MIT Lincoln Laboratories and Windworks Inc. recognized the need for power quality improvement in these single phase utility interactive systems. The contract for Further Development of the Single Phase LCI focused on this objective by setting a power quality goal of unity power factor and 5% THD-AC current. An AC network was developed which obtained this goal. Ultimately, the cost impact on the product will be known when minimum guidelines are established for desired power quality. The guidelines must be substantiated by quantified harmonic affects on utility power quality. Unfortunately, these are not established at this time. In lieu of this, current design guidelines are presented. (no refs.)

Measurements of the distribution of the flux of energy in the focus of a solar concentrator with visualization techniques .... See Entry 71213

Geometrical concentration characteristics of a linear Fresnel reflector using a fin receiver .... See Entry 71214

Enhancement of radiation cooling by means of reflectors .... See Entry 71339

Low-cost modular array-field designs for flat-panel and concentrator photovoltaic systems .... See Entry 73451

Operational experience with a 35 kWp concentrating photovoltaic system .... See Entry 73456

Field trial of rural solar photovoltaic system .... See Entry 73457

Study of a photovoltaic concentrating system like 'SOPHOCLE' in fluctuating mode .... See Entry 73458

Performance of 1 kW peak concentrating photovoltaic array .... See Entry 73459

Photovoltaic concentrator module characterization .... See Entry 73460

Solar gasification of carbonaceous materials .... See Entry 73467

A two-pass solar air heater .... See Entry 73471

Empirical equations for calculation of CPC collector loss coefficients .... See Entry 73474

A parametric study on solar ponds .... See Entry 73476

Optimal control of solar heating and off-peak energy storage installations .... See Entry 73478

Appropriate sizing of solar heating systems .... See Entry 73479

A simple computer program to model three-dimensional underground heat flow with realistic boundary conditions .... See Entry 73481

A simple hourly clear-sky solar radiation model based on meteorological parameters .... See Entry 73888

86.10Z Other topics

73428 Energy recovery from gases in blast furnaces.
Tech. Mod. (France), vol.74, no.9-10, p.31-4 (Sept.-Oct. 1982). In French. [received: March 1983]
A method developed in the USSR extracts gas from the mouth of a blast furnace for expansion in a GOUBT compressorless gas turbine, where its pressure falls to a level appropriate for piping to customers. The turbine can function with gas having a wide range of dust. The turbine rotor is coupled directly to an electric generator. Two installations in Japan are depicted. More than 10 years' experiments at the Cherepovets metallurgical plant are described and their results are summarised. (no refs.) *M.B.D.*

86.30 ENERGY CONVERSION

73429 Batteries and energy systems. 2nd edition. C.L.Mantell.
New York, USA: McGraw-Hill (1983), xv+319 pp. [0 07 040031 8]
The following topics were dealt with: thoroughly revised and brought completely up to date, this comprehensive guide covers the full range of today's methods for providing packaged power for civilian, industrial, military, and space applications. Embracing everything from current-producing batteries to regenerative electrochemical systems to photovoltaic solar cells, this unique work spells out the technical where, why, and how of just about any battery or energy system one is likely to encounter. Numerous tables, drawings, and photographs give important facts and data in concise form. For this expanded Second Edition, entirely new chapters have been added on the use of batteries in windmills and on the effect of EMD (electrolytic manganese dioxide) on battery performance. The first book to treat the topic as a coordinated whole, this is a completely updated treasury of solid, practical information on the full spectrum of batteries and energy systems. It will prove invaluable to everyone whose daily work requires a thorough understanding of the properties, components, and operation of batteries—or who has to choose or specify batteries and energy systems that will do the job that needs to be done both efficiently and economically.

86.30E Primary cells

73430 Lithium cells. K.Smrcek, O.Marholova.
Elektrotech. Obz. (Czechoslovakia), vol.72, no.3, p.134-9 (March 1983). In Czech.
Discusses the contemporary problems of lithium cells. The authors turn attention to the main types of primary cells, presents their properties and characteristics and differences with respect to classical types. Further, they mention the complicated problems concerning the secondary cells including the up to now unsolved questions limiting the fast development of a new accumulator with a lithium anode. (13 refs.)

The electrochemistry of molten lithium chlorate and its possible use with lithium in a battery .... See Entry 73342

86.30F Secondary cells

73431 In situ Raman spectroscopic studies of the rechargeable low temperature molten salt cell Na/beta″-alumina/S(IV) in $AlCl_3$-NaCl. K.Tanemoto, A.Katagiri, G.Mamantov (Dept. of Chem., Univ. of Tennessee, Knoxville, TN, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.890-2 (April 1983).
The rechargeable cell $Na/\beta''=Al_2O_3/S(IV)$ in $AlCl_3$-NaCl is operated at 180°-250°C and has an open-circuit voltage of 4.2 V. The Raman spectroscopic studies described by the authors were undertaken to provide a better understanding of the chemistry that takes place during discharge and charge processes in the positive electrode compartment. (16 refs.)

The electrochemistry of molten lithium chlorate and its possible use with lithium in a battery .... See Entry 73342

Lithium cells .... See Entry 73430

86.30G Fuel cells

73432 Energy storage in a fuel cell with bipolar membranes burning acid and hydroxide. A.T.Emren, V.J.M.Holmstrom (Dept. of Phys. Chem., Univ. of Goteborg, Goteborg, Sweden).
Energy (GB), vol.8, no.4, p.277-82 (April 1983).
A battery is described, in which bipolar membranes are used to split water into acid and hydroxide. The liquids may be stored for an indefinite time, and energy may be recovered at room temperature. It is shown that the liquids are able to store about 400 kJ/litre, which roughly corresponds to pumping water up to an altitude of 40 km. Bipolar membranes of low area resistance have been made and tested. The area resistance appears to have been 2-3 Ω cm^2. A battery containing 7 unit cells has been constructed and tested. The maximum output voltage has been 1.8 V. The cost for energy storage is estimated to range from $0.1 to 2.5 per kWh depending on the mode of operation. (5 refs.)

73433 Evaluation of tetrafluoroethane-1,2-disulfonic acid as a fuel cell electrolyte. P.N.Ross,Jr. (Materials & Molecular Res. Div., Lawrence Berkeley Lab., Berkeley, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.4, p.882-5 (April 1983).
Reports some physical properties of TFEDSA relevant to fuel cell use and preliminary examinations of this electrolyte in fuel cells with hydrogen containing carbon monoxide. The conclusion of this study of TFEDSA as a fuel cell electrolyte is that because of poor conductivity at higher concentration it offers no advantage over H_3PO_4 in fuel cell applications where systems considerations favor cell temperatures above ca. 120°C. (17 refs.)

Hydrogen as a fuel .... See Entry 73400

86.30J Photoelectric conversion: solar cells and arrays

73434 The influence of the interface state on the properties of solar cell semiconductor electrodes. Lin Zhang-da, Zhou Pei-zhen, Chen Yun-qi, Deng Hui-guo, Qi Shang-xue, Wang Chang-heng, Xie Kan (Inst. of Phys., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.36-44 (Jan.-March 1983). [received: May 1983]
An n-Fe_2O_3 film was grown on an n-Si substrate which had undergone surface treatment to form a double layer semiconductor electrode. The influence of the interface state on the electrode properties was studied. From photoluminescence measurements, the authors found that an interface state with high density of states exists lying above the top of the Fe_2O_3 valence band at 1.61 eV. The Fermi level is pinned by this interface state. Using energy band profiles, they give an explanation for the photoluminescence, as well as a theoretical calculation and analysis for the capacity-voltage curves and photo-current-voltage curves. These theoretically calculated curves agree well with the experimental data. This double layer semiconductor electrode with an interface state with high density of states is promising material for

solar cells of good stability and high photo-electric conversion efficiency. (7 refs.)

73435 **Some problems of MIS photovoltaic cells with a dominating minority charge carrier flow.** S.Baratka.
Elektrotech. Obz. (Czechoslovakia), vol.72, no.3, p.153-6 (March 1983). In Czech.
Surveys some problems connected with the performance of MIS photovoltaic cells. It mentions the properties of the oxide layer which influences the no-load voltage. Problems of antireflection surfaces are treated including the light reflection properties of the cells surface. The degradation factors are also described which exist in case of the MIS cells having the upper collector electrode in form of a grid applied directly to the insulation layer. (16 refs.)

73436 **Solar cells. I.** D.Teodorescu.
Elektr. Masch. (Germany), vol.62, no.3, p.72-7 (March 1983). In German.
Describes history and state of the art of solar cells. With monocrystal silicon cells an efficiency of about 20% can be achieved. Polycrystalline and amorphous silicon can be used but with high (over 1000) concentration factors, GaAs cells are more efficient. The average efficiency of mass produced amorphous Si cells is 6% (theoretical: 15%). (no refs.) *J.S.*

73437 **Screen printed CdS/CdTe solar cell.** H.Matsumoto, H.Uda, A.Nakano, Y.Komatsu, K.Kuribayashi, S.Ikegami (Wireless Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.120-6 (Feb. 1983). In Japanese.
The preparation conditions of a screen printed CdS/CdTe solar cell, which is prepared on a glass substrate by successively repeating screen printing and heating of each paste (consisting of CdS, CdTe, C and other electrode materials), were investigated. The optimum sintering conditions of CdS, CdTe, C and other electrode materials, were investigated. The optimum sintering conditions of CdS and CdTe films were 690°C for 90 minutes and 620°C for 60 minutes, respectively. Three kinds of solar cells were prepared on 10×10 cm^2 glass substrates by changing the print pattern of the cells. The first had 1 cell on a substrate, the second had 2 small cells connected in series on a substrate, and the last had 10 small cells connected in series on a substrate. The output voltages of these three cells at the optimum loads were 0.45 V, 0.90 V, and 4.5 V, respectively. A lot of the second type cells were produced, and the maximum intrinsic efficiency of 9.0% (5.8% for total substrate area) was obtained. A 24-watt module which consisted of 48-second type cells connecting in series was produced. The module showed photovoltaic characteristics of $V_{OC}=68.5$V, $I_{SC}=0.725$ A, maximum power $=24.1$ W and module efficiency ≈ 5.0% for total substrate area under a 100 mW/cm^2 solar simulator. (14 refs.)

73438 **Use of polymeric materials in the assembly of solar cells.** A.Addeo, V.Bonadies, C.Carfagna, G.Guerra, A.Moschetti (Istituto 'G. Donegani', Naples, Italy), L.Nicolais.
Sol. Energy (USA), vol.30, no.5, p.421-4 (1983).
A new photovoltaic module made of solar cells encapsulated in polymeric matrices is described. The encapsulation system utilizes polymers of the acrylate family which have different thermal and mechanical encapsulate photovoltaic modules. (12 refs.)

73439 **Nouvelles methodes de preparation de materiau semi-conducteur cellules solaires Cu_2S-CdS (New methods for the production of the solar cell semi-conductor material Cu_2S-CdS).** J.Vedel, J.Lahaye, S.Martinuzzi, J.Bougnot.
Report EUR 8210 FR, Comm. European Communities, Luxembourg (1982), 93 pp. In French. Contract 430-78-1 ESF.
Gives a detailed study of the research programme starting with the preparation and characteristics of Cu_2S layers using chemical evaporation. A physiochemical study is then made on the characteristics of aerosols on the conductivity of CdS films. Further sections cover the physical characteristics of thin CdS layers using electrical measurements as a function of temperature to determine reactions, mobility and energy levels. A description of the actual use of responses follows, as applied to areas more than 4 cm^2. A similar section gives details of making and using Cd_2S by 'dipping' as a function of sparking obtained by chemical evaporation. The final section covers the installation of a pilot works and the manufacture of this type of solar cell.

73440 **Omnidirectional proton irradiation of thin and thick solar cells.** M.W.Walkden, A.A.Dollery (Space & New Concepts Dept., Royal Aircraft Establ., Farnborough, England).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.295-300
Proton damage ratios, relating the damage caused by 1 MeV electrons to that caused by protons of various energies, have been found for hemispherical isotropic proton conditions. The proton fluences were incident on either the front or rear of the cell. Six types of cell were used in the study, ranging in thickness from 50 to 250 μm. The proton damage ratios have been found to be much higher than those derived in earlier studies where normal incidence protons were employed, although the differences are somewhat offset by the cell cover glass or rear shield. A comparison is made with the earlier work in conjunction with proton maps AP6 and AP7 with the later AP8 series. (3 refs.)

73441 **Prediction of solar cell performance in space.** R.L.Statler, D.H.Walker (Naval Res. Lab., Washington, DC, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.301-6
Discusses two factors which are important in such predictions. The first is the gradual deterioration of the optical transmissivity of the coverglass and its adhesive layer, using data derived from the solar cell experiment on the Naval Research Laboratory NTS-2 satellite. The magnitude of this effect is shown through the interpretation of satellite data. The second factor is temperature enhanced radiation damage which was observed during radiation experiments at low dose rates on silicon solar cells. These experiments are being carried out at the NRL Cobalt 60 facility. The observed radiation damage is shown to be strongly dependent on the temperature of the silicon cells during irradiation. The magnitude of this effect is shown in its influence on the interpretation of satellite data. (4 refs.)

73442 **Effect of electron flux on radiation damage in GaAs solar cells.** R.Y.Loo, G.S.Kamath, R.C.Knechtli (Hughes Res. Labs., Malibu, CA, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.307-9
Compares the defect levels and the power ratio of the GaAs solar cells under various irradiation conditions. IN a 200°C continuous annealing experiment, the GaAs solar cells which were irradiated at a flux of 2×10^9 ecm^{-2} s^{-1} suffered less power degradation than the cells which were irradiated at the same temperature at a higher flux of 4×10^{10} ecm^{-2} s^{-1}. After the continuous annealing experiment, the authors performed a single-step post annealing at 200°C for 40 hr on these irradiated cells. They observed an additional improvement in power recovery only on those cells irradiated at the high flux of 4×10^{10} ecm^{-2} s^{-1}. The DLTS data indicates that the defect density decreases with lower electron flux. Both of these observations strongly suggest that the continuous annealing in GaAs cells can be effective at temperatures as low as 150°C, or even less in a space environment such as geosynchronous orbit. (2 refs.)

73443 **Irradiated solar cells fabricated from gallium-doped/boron-doped FZ and CZ silicon.** J.A.Minahan, N.Neal, D.Dionne, W.E.Taylor (Spectrolab Inc., Sylmar, CA, USA), T.M.Trumble.
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.310-15
Compares the tolerance to various fluence levels of 1 MeV electrons of solar cells fabricated from: gallium-doped multipass FZ silicon, boron-doped multipass FZ silicon, gallium doped CZ silicon and boron doped CZ silicon. The FZ materials used for the study were of ultra high purity with low levels of oxygen and carbon. Bulk analysis of gallium doped cold crucible (C^3Z) silicon is included and compared with gallium doped FZ silicon. Bulk analysis of selected wafers in the various crystals was performed by low temperature FTIR and surface photovoltage. Measurement of AMO electrical characteristics and spectral response of solar cells fabricated from these silicon materials before and after 1 MeV electron irradiation are used to compare radiation tolerance of the materials. (11 refs.)

73444 **High efficiency approaches [solar cells].** S.C.Jain (Solid State Phys. Lab., Delhi, India), R.Mertens, R.Van Overstraeten.
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.333-9
Thin silicon structures in which carrier and photon reflections occur in both sides offer the possibility of very high efficiencies. High doping levels in these structures must be avoided to obtain emitter and base regions that are transparent for the minority carriers. Highly efficient back-surface fields are low front-surface recombination velocity are additional requirements to achieve high efficiencies. MIS and SIS emitters, though promising from theoretical viewpoint, suffer from technological difficulties and stability problems leaving a moderately doped n-p junction with passivated surface as the optimum emitter structure. Theoretical calculations show that the built-in voltage is the upper limit of V_{oc} in such a cell as the cell thickness becomes small. Bandgap narrowing makes the built-in voltage considerably smaller than the bandgap E_g. (29 refs.)

73445 **A survey of grid technology [solar cells].** P.A.Iles (Applied Solar Energy Corp., City of Industry, CA, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.340-7
Discusses grid patterns used to increase the efficiency of almost all forms of solar cells. The author surveys grid design principles and procedures, the technology of grid formation, including some techniques required for special cell designs. Current experimental results are presented. (38 refs.)

73446 **Surface effects in high voltage silicon solar cells.** A.Meulenberg, R.A.Arndt (COMSAT Labs., Clarksburg, MD, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.348-54
The surface of low-resistivity silicon solar cells appears to be a major source of dark diffusion current. This region, consisting of the interface and the adjacent heavily doped layer, therefore, prevents attainment of the high open-circuit voltages expected from these cells. The authors describe the experimental effort carried out to reduce the varius contributions of dark current from the surface. Analysis of results from this effort points to a means of improving cell voltages by changing processing and structures. (14 refs.)

73447 **How will we get to 20% (AM1) efficient Si solar cells?.** M.Wolf (Dept. of Electrical Engng. & Sci., Philadelphia, PA, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.355-60
Application of recent 'more exact modelling' methods has indicated the design principles for the achievement of silicon solar cells with efficiencies above 20% AM1. These design principles are primarily aimed at reducing the total device minority carrier recombination rate, not so much to improve the collection efficiency, but more to attain higher voltages. The reduction of recombination is attacked along three paths: increased minority carrier lifetime, reduced volume for bulk recombination, and reduced surface recombination. The lifetime control dictates the avoidance of severe Auger recombination anywhere in the device. Simultaneously, bandgap narrowing effects will also be minimised. The cells will be multilayer structures, which include high/low junctions in the base region as well as in part of the front region. The thickness of each of the layers needs to be designed in accordance to the electronic properties actually achieved in it and in the other layers. (11 refs.)

73448 **High efficiency silicon solar cells.** H.T.Weaver, R.D.Nasby (Sandia Nat. Labs., Albuquerque, NM, USA).
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.361-5
A summary of data on high-performance silicon solar cells is presented. Cells are discussed which represent state-of-the-art single crystal silicon devices and which exhibit power conversion efficiencies above 20 percent at concentration. One group of p^+-n cells exhibited open-circuit voltages (V_{oc}) as high as 0.653 V at one sun insolation. This large V_{oc} suggests that bandgap narrowing effects are smaller than has been assumed in the past for this type cell. (10 refs.)

73449 **Effect of injection level on minority carrier lifetime [solar cells].** S.K.Agarwal, Harsh, S.C.Jain (Solid-State Phys. Lab., Delhi, India), P.De Pauw, R.Mertens, R.Van Overstraeten.
Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.366-70
Results of theoretical investigations of minority carrier recombination at clusters of defects or grain boundaries, at the back contact and in the emitter at different injection levels are given and compared with the experimental results. The values of the effective lifetime increase with injection level when the effect of defect clusters (or grain boundaries) is important whereas they decrease with injection level due to recombinations in the emitter and/or at the back contact. (12 refs.)

73450 Parallel-processing with surface plasmons, a new strategy for converting the broad solar spectrum. L.M.Anderson (NASA Lewis Res. Center, Cleveland, OH, USA).

Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.371-7

A new strategy for efficient solar energy conversion (1) is based on parallel-processing with surface plasmons: guided electromagnetic waves supported on thin films of common metals, like aluminum or silver. The approach is unique in identifying a broadband carrier with suitable range for energy transport, and an inelastic tunneling process which can be used to extract more energy from the more energetic carriers, without requiring different materials for each frequency band. The aim is to overcome the fundamental 56 percent loss associated with mismatch between the broad solar spectrum and the monoenergetic conduction electrons used to transport energy inconventional silicon solar cells. The author presents a qualitative discussion of the unknowns and barrier problems, including ideas which we are testing for coupling surface plasmons into the tunnels, a step which has been the weak link in the efficiency chain. (37 refs.)

73451 Low-cost modular array-field designs for flat-panel and concentrator photovoltaic systems. H.N.Post (Sandia Nat. Labs., Albuquerque, NM, USA), D.C.Carmichael, G.Alexander, J.A.Castle.

Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.378-83

Describes the design and development of low-cost, modular array fields for flat-panel and concentrator photovoltaic (PV) systems. The objective of the work is to reduce substantially the cost of the array-field balance-of-system (BOS) subsystems and site-specific design costs compared with previous PV installations. These subsystems include site preparations, foundations, support structures, electrical wiring, grounding, lightning protection, electromagnetic interference considerations, and controls. To reduce these BOS and design costs, standardized modular ('building-block') designs for flat-panel and concentrator array fields have been developed that are fully integrated and optimized for lowest life-cycle costs. Using drawings and specifications now available, these building-block designs can be used in multiples to install various size array fields. The developed designs are immediately applicable and greatly reduce the array-field BOS costs. (8 refs.)

73452 Characterization of the electrical output of flat-plate photovoltaic arrays. C.C.Gonzalez, G.M.Hill, R.G.Ross,Jr. (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).

Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.384-90

The electric output of flat-plate photovoltaic arrays changes constantly, due primarily to changes in cell temperature and irradiance level. As a result, array loads such as direct-current to alternating-current power conditioners must be able to accommodate widely varying input levels while maintaining operation at or near the array maximum power point. The results of an extensive computer simulation study that was used to define the parameters necessary for the systematic design of array/power-conditioner interfaces are presented as normalized ratios of power-conditioner parameters to array parameters, to make the results universally applicable to a wide variety of system sizes, sites, and operating modes. The advantages of maximum power tracking and a technique for computing average annual power-conditioner efficiency are discussed. (4 refs.)

73453 Improved photovoltaic battery chargers for lower maintenance and higher efficiency. A.R.Millner (TriSolarCorp, Bedford, MA, USA).

Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.400-5

A novel system controller has been developed and tested, suitable for many remote lead acid battery charging applications. The state of charge of the battery is estimated by integrating the battery current, while the optimum amount of equalization charge is simultaneously estimated. The results are bounded by a temperature compensated voltage limit algorithm to ensure convergence of the model to the actual battery being controlled. The battery therefore requires less watering and will probably last longer. The charging mode is further enhanced by a modular high-efficiency switching DC to DC regulator between the source and the battery, driven by a maximum power controller. This allows the photovoltaic array to operate at its optimum voltage regardless of the battery voltage, enhancing the system output during design-limiting winter months. (2 refs.)

73454 Impurities in polycrystalline silicon solar cells. A.Rohatgi, J.R.Davis, R.H.Hopkins, P.Rai-Choudhury (Westinghouse R&D Center, Pittsburgh, PA, USA).

Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.44-16

The effects of grain boundaries and impurities on silicon solar cell performance have been studied in single-crystal and polycrystalline ingots by intentionally incorporating 2×10^{12} cm^{-3} molybdenum, 10^{14} cm^{-3} titanium, and $\sim10^{15}$ cm^{-3} chromium during Czochralski growth. Mo, Ti, and Cr degrade solar cell performance by inducing deep levels in silicon. Electrically active grain boundaries also reduce cell performance by inducing carrier recombination in the bulk as well as in the depletion region of the solar cell. At low impurity concentrations, polycrystalline cell performance is controlled by grain-boundary recombination, while at high concentrations, it is dominated by the impurity, resulting in equal efficiencies for single-crystal and polycrystalline cells. Impurity-grain-boundary interactions are species dependent and result in a decrease in impurity-induced deep-level concentration: Cr exhibits the largest interaction, Ti a weak interaction, and Mo no measurable effect. (16 refs.)

73455 Defect analysis of RTR ribbons. B.L.Sopori, R.J.Ellis, R.N.Legge, K.R.Sarma, I.A.Lesk, C.Ackerman (Solavolt Internat., Phoenix, AZ, USA).

Conference Record of the Sixteenth IEEE Photovoltaic Specialists Conference - 1982, San Diego, CA, USA, 27-30 Sept. 1982 (New York, USA: IEEE 1982), p.431-6

An analysis of structural defects in RTR ribbons shows that intragrain defects (viz dislocations) play a dominant role in controlling the performance of solar cells. The nature of dislocations, their distribution along different directions, and their dependence on grain orientations in the ribbons are discussed. Characteristics of twins in RTR ribbons and their photovoltaic behavior are identified. (2 refs.)

73456 Operational experience with a 35 kWp concentrating photovoltaic system.

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.184-8

Acurex Corporation completed the installation and startup of a 35-kWp concentrating photovoltaic system in October 1981. This paper describes the operation and performance of the field during the first 6 months of operation. The system has performed at a lower level than predicted, partly due to the unusual climatic conditions experienced at the site. The operational experience indicates three problem areas in the system design. First, some receiver degradation has occurred due to manufacturing defects which have been corrected. Second, the power conditioning unit has demonstrated low reliabiity in the Hawaiian environment. Third, corrosion problems associated with the site have accounted for a major portion of the required maintenance. Overall, the system has operated reliably, except for the power conditioning unit, and most system components do not show signs of degradation. (no refs.)

73457 Field trial of rural solar photovoltaic system. P.Basu, K.Mukhopadhyay, T.Banerjee, S.Das, H.Saha (Dept. of Phys., Univ. of Kalyani, Bengal, India).

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.203-9

A small stand-alone solar photovoltaic system using silicon solar cells has been set up in a village near Kalyani, India, to meet two typical rural applications like (a) village community cum adult literacy centre, (b) irrigation pumping. A television set of 65 watts and three fluorescent lamps of total 100 watts and a DC pump set of about 300 watts are being used as load. Power conditioning units include high frequency DC-DC convertor for TV set, DC-AC invertor for fluorescent lamps. Separate storage batteries have been used for the nighttime and daytime load. The performance of solar pump has been investigated for different options like with or without storage battery with a view to determine the cost effective option for stand-alone solar photovoltaic irrigation pumping. The balance of system costs of this system has been estimated and compared with that reported in the USA. The electrical and thermal performances of the solar cell modules have been investigated. The social impact of this system in the village has also been studied. These observations lead to some interesting features of a typical SPS in rural conditions in India. (8 refs.)

73458 Study of a photovoltaic concentrating system like 'SOPHOCLE' in fluctuating mode. B.Laurent, Pham Van Vui, G.Vialaret (Lab. d'Automatique et d'Analyse des Systemes, CNRS, Toulouse, France).

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.212-16

SOPHOCLE is a Fresnel lenses concentration photovoltaic generator using silicon cells. It is tested under various climatic environments, by means of a measurement and registration system. The recorded data are treated at LAAS (Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse). Different parameters are studied to define the generator performances and the dispersion of solar characteristics at different places. Their analysis by Monte-Carlo methods has allowed the creation of a mathematical model, particularly for time constants, efficiency and storage. The purpose is to understand at any time the whole behaviour of the system by means of statistics on real data and to detect any eventual defects. (3 refs.)

73459 Performance of 1 kW peak concentrating photovoltaic array. G.Sala, F.Chenlo (Inst. de Energia Solar, Univ. Politecnica Madrid, Madrid, Spain).

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.217-21

The RA concentrating photovoltaic array has been measured during its first year of operation. Electrical, optical and mechanical performances are presented. The overall efficiency is 4%. This low value is due to non uniform illumination and to dispersion of the solar cell characteristics. (4 refs.)

73460 Photovoltaic concentrator module characterization. H.J.Gerwin (Sandia Nat. Labs., Albuquerque, NM, USA).

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.222-6

A number of photovoltaic concentrator module designs have been tested under similar conditions, and the results are presented to show meaningful performance characteristics. The concentrator designs include actively cooled linear parabolic troughs and linear Fresnel lenses, as well as passively cooled point-focus Fresnel lenses. These modules were produced within the past three years and represent significant improvements over earlier concentrator designs. All testing was performed with natural sunlight in the Sandia National Laboratories test facility in Albuquerque, New Mexico. Each module was run through a series of standard tests to determine performance at normal operating and off-design conditions. These tests included maximum power tracking under a range of insolation values and temperature variations. Complete current-voltage scans were made at frequent intervals throughout the test period for each module. Using a multiple linear regression analysis technique, maximum power efficiencies were determined by normalizing the operating points for direct normal insolation (800 W/m^2) and average cell temperature (28°C). (no refs.)

73461 A microprocessor-based instrument for automatic solar cell characterizatin. G.C.Cardinali (CNR, Istituto LAMEL, Bologna, Italy).

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.232-6

The paper describes a microprocessor-controlled instrument for automatic characterization of photovoltaic cells. Accuracy, speed and flexibility, especially as regards run-time selection of measurement and data processing modalities, represent the main characteristics of the proposed system. As output the instrument provides plots of the current-voltage and power-voltage curves, together with information related to the measured data, such as cell fill factor and efficiency. The system turned out to be particularly useful for automatic classification and selection of photovoltaic cells for solar panels. (3 refs.)

73462 Analysis of hot-spot-effects in encapsulated photovoltaic generators by laser scan and partial shadowing. G.H.Hewig, H.-P.Hobner (Inst. fuer Phys. Elektronik, Univ. Stuttgart, Stuttgart, Germany).

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.291-5

The connection of several solar cells in a generator implicates some problems unknown to a single solar cell. Due to variations in the short circuit current of the different solar cells, caused either by partial shadowing or variations during the production process, some cells may act as a load, thus resulting in hot-spot-effects. The operating condition of a solar cell in a photovoltaic generator, with the single cells connected either in series or parallel, is analysed. To investigate encapsulated modules, the methods of laser scan and partial shadowing are employed. The combination of both methods yields the short circuit current and the reverse IV-characteristics of each solar cell, which both are important to classify the different cells according to the possible appearance of hot-spots. Hot-spot-effects in Si-solar cell generators are quite possible due to their high shunt resistance, thus withstanding quite high reverse voltages, which may result in a high power consumption of that solar cell, if their short circuit current is lower than the average current of the generator. The possibility of the appearance of hot-spots in a Cu_2S-CdS solar cell generator is much lower due to the fact that thin film solar cells in general show a breakthrough in their reverse characteristic at much lower reverse voltages. (4 refs.)

73463 Reverse bias power dissipation of shadowed or faulty cells in different array configurations [solar cells]. P.Spirito (Istituto Elettrotecnico, Univ. of Naples, Naples, Italy), V.Albergamo.
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.296-300
An analysis has been made of the maximum power dissipation in reverse biased shadowed cells. The results of the analysis are presented for different series-parallel configurations; for each case the bias point of the shadowed cell is determined as a function of the 'shadowing degree', defined as the ratio between the I_{sc} of the shadowed cell and the I_{sc} of the illuminated ones. The maximum power dissipation allowable for the cell in a given module is computed by using the NOCT values of the module itself. The results show that a large paralleling of cells can lead to severe stresses if more than one cell is shadowed, and to a greater sensitivity to the 'hot spot' phenomenon. (5 refs.)

73464 Disequilibriums in series connected solar cells: an approach to the protection by parallel diodes. J.A.Roger, S.Massaad, J.Posbic, J.Pivot (Dept. de Phys. des Materiaux, CNRS, Univ. de Lyon, Villeurbanne, France).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.301-6
This paper presents the first systematic comparison between experiments and theory leading to a better understanding of the 'hot spot' problem in PV arrays, and to a better determination of the major parameters influencing these disequilibriums. Measurements are performed on a single string of 408 series connected solar cells, and currents and dissipated power are recorded as a function of the number of cells that are protected by a given by-pass diode. Experimental data are in a very good agreement with a theoretical approach, summarized here, that allows a more complete investigation: the cell's parameters, especially the shunt resistance, are found to govern the 'hot spot' formation and influence the aptitude of the diode to protect the cells. Various loading conditions are considered, and numerical values are given. This paper describes also the data acquisition system designed in our laboratory, that will be extended to analyze in summer 1982 the mismatch effects and the possible disequilibriums in the 5 kW array of the Refuge des Evettes in France. (2 refs.)

Recrystallization of amorphous and small grain size polycrystalline silicon ....See Entry 72998

Problems and prospects of solar power stations ....See Entry 73412

Etude de faisabilite d'une centrale photovoltaique de taille moyenne (0,5 - 1 MW), avec stockage (Feasibility study for a medium-sized (0.5 - 1.0 MW) photovoltaic power station, with storage) ....See Entry 73425

86.30K Photoelectrochemical conversion

73465 The relation between performance and stability of Cd-chalcogenide/polysulfide photoelectrochemical cells. I. Model and the effect of photoetching. R.Tenne, N.Muller (Dept. of Plastics Res., Weizmann Inst. of Sci., Rehovot, Israel), Y.Mirovsky, D.Lando.
J. Electrochem. Soc. (USA), vol.130, no.4, p.852-60 (April 1983).
Photoetching of CdS, CdSe and CdTe electrodes, which is known to improve their quantum efficiency in electrochemical solar cells, is found to improve the electrode stability in polysulfide electrolyte, even though the photocurrent is increased after the photoetching (under constant illumination intensity). A simple model for the performance and the stability of Cd-chalcogenide/polysulfide photoelectrochemical cells is suggested, according to which any parameter that increases the quantum efficiency of the photoelectrode also increases, the electrode stability. Any impediment on the flow of holes into the electrolyte leads to increased photocorrosion and surface recombination. The validity of this model is tested by measuring the quantum efficiency, electrode stability, and photocurrent transients at various light intensities and electrolyte concentrations. (32 refs.)

Stability of semiconducting TiO_2 photoanodes ....See Entry 72444

86.30P Photosynthesis

(see also 87.25 Cellular biophysics)

On gasohol and energy analysis ....See Entry 73399

86.30Q Chemical energy conversion

(for electrochemical conversion, see 86.30D; for photoelectrochemical conversion, see 86.30K)

73466 Coal gasification using solar energy. V.K.Mathur, R.W.Breault, S.Lakshmanan (Dept. of Chem. Engng., Univ. of New Hampshire, Durham, NH, USA).
Sol. Energy (USA), vol.30, no.5, p.433-40 (1983).
A Gas Recirculation Solar Hybrid Technique developed at the University of New Hampshire for the gasification of carbonaceous materials using solar energy is discussed. The cost of substitute natural gas (SNG) manufactured from conventional and hybrid units of 7.08×10^6 m^3 per day (250 MM SCF/D) capacity from various feed stocks has been computed and compared. It is estimated that by 1995 the cost of SNG from a hybrid system will be competitive with conventional gasification systems. The size of the plant versus gas cost has also been studied and it is found that for plants smaller than 0.566×10^6 m^3 per day (20 MM SCF/D) of SNG, the gas cost increases exponentially. A bench scale unit of the UNH Gas Recirculation System for coal carbonization has been tested using an electric heater to simulate solar energy with nitrogen as the heat carrier gas. This study shows the successful carbonization of coal by indirectly transferring simulated solar heat, using the gas recirculation technique. The products obtained are similar to those from a conventional carbonization unit. Our results obtained so far show the UNH Gas Recirculation Solar Hybrid process is economically and technically feasible. (22 refs.)

73467 Solar gasification of carbonaceous materials. R.W.Taylor (Lawrence Livermore Lab., Livermore, CA, USA), R.Berjoan, J.P.Coutures.
Sol. Energy (USA), vol.30, no.6, p.513-25 (1983).
Charcoal, wood and paper have been gasified in a packed-bed reactor using steam and solar energy. The steam was generated by spraying water directly on to the surface of the fuel and, at the same time, heating the fuel at the focus of a solar furnace. Half of the steam reacted with carbon and 30 per cent of the incident solar energy was stored as chemical enthalpy. The performance of a fluidized-bed reactor was compared to that of a packed-bed reactor using charcoal and CO_2. The fraction of the incident solar energy utilized to produce CO (stored) was 10 per cent in the case of the fluidized-bed reactor and 40 per cent for the packed-bed reactor. The fuel value of the gas produced from the steam-gasification of wood and paper was 65 kcal/mole (320 Btu/lb). On an ash free basis the volume yield of the gas was 1 ± 0.1 m^3/kg. (10 refs.)

Energy storage in a fuel cell with bipolar membranes burning acid and hydroxide ....See Entry 73432

86.30R Thermal energy conversion (heat engines and heat pumps)

73468 Energy systems in modular construction. K.G.Heyne, I.-F.Primus (Motoren-Werke Mannheim AG, Mannheim, Germany).
Elektr. Energ.-Tech. (Germany), vol.28, no.2, p.11-15 (April 1983). In German.
The need for economical and fuel-efficient energy supplies has led to the increasing use of newer technical solutions which include combined heat/power generation with internal combustion engines, heat pump installations with internal combustion engines, tandem heat/power stations, pyrolysis plant, refuse utilisation and heating schemes with heat pumps. Rationalisation, standardisation, and the use, where possible, of factory-complete units result in cost effective and environmentally kind schemes. The main constructional features, arrangements, ratings and sizes of a modular system comprising a machine/accessories module, a heat exchanger module and a building module are outlined. (2 refs.) *P.G.R.*

73469 Methods of determining thermodynamic efficiency of compressor-type heat pumps. V.Havelsky.
Energetika (Czechoslovakia), vol.33, no.4, p.141-4 (April 1983). In Czech.
Thermodynamic efficiency of heat-pump cycles as well as the economic aspect of their employment can be assessed on the basis of a knowledge of the actual coefficient of performance, which is a function of the thermodynamic properties of the operating medium and design parameters of a concrete cycle. The author proposes the possibility of determining the actual coefficient of performance by a computing method based on the theoretical Rankine coefficient of performance; the obtained results are comparable with experimental data. In conclusion, the paper discusses the possibility of employing the proposed computing method for the basic computation and design of a concrete heat-pump cycle. (6 refs.)

73470 Refrigerant-absorption pair R22-DEGDME. E.Ando, I.Takeshita (Central Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.102-10 (Feb. 1983). In Japanese.
A working fuel has been developed for gas-fired absorption heat pumps with air as a heat source. This system requires a refrigerant and absorbent pair which has the following characteristics: low freezing point (below 0°C), small specific volume and high thermal stability as well as other physical and chemical properties which result in good performance of the system. Combinations of seventy kinds of fluorocarbon compounds as refrigerants and more than one hundred fifty kinds of organic compounds as absorbents were investigated from the above points of view. As a result, a new pair, R22-DEGDME, is viewed as a very promising fluid pair. In order to design this system, data regarding the thermophysical properties, in other words, vapor pressure, specific heat capacity and heat of mixing of ths pair were needed, so they were measured and expressed as functions of temperature and concentration. The equilibrium vapor pressure diagram and the enthalpy-concentration diagram for this pair have been obtained. (9 refs.)

A simple computer program to model three-dimensional underground heat flow with realistic boundary conditions ....See Entry 73481

86.30S Photothermal conversion

73471 A two-pass solar air heater. A.K.Bhargava (Phys. Dept., Delhi Univ., Delhi, India), H.P.Garg, V.K.Sharma.
Energy (GB), vol.8, no.4, p.267-76 (April 1983).
An air heater, in which the air first flows between metallic and cover plates and is then made to flow between two metallic plates in opposite direction, is discussed theoretically. The governing equations of the model are solved explicitly under suitable conditions. The measured values of the solar isolation and ambient temperature are represented by Fourier series. The effects of collector length and flow rate have been studied. The air heater in this mode of operation is more efficient than one in which air flows between two metallic plates in the same direction, provided the plate length is less than 5 m. (8 refs.)

73472 Solar-selective paints. M.Maki, H.Fukuda, Y.Kaneko (Housing Products Res. Lab., Matsushita Housing Products Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.69-77 (Feb. 1983). In Japanese.
A solar-selective paint to provide a high absorption over the solar spectrum and reduction of thermal radiative heat losses to solar collector surfaces. Of paints which are available for various present solar collectors, two types of solar-selective paints have been developed. One is applied to a metal surface having high infrared reflection, and the other is applied to a plastic surface having low infrared reflection. These paints can make use of ordinary painting methods and having low infrared reflection. By choosing the optimum paint type in accordance with the uses and the specifications of solar collectors, it has become possible to assemble solar-heat systems with high cost-performance efficiency. (7 refs.)

73473 Monthly average optical efficiency of flat plate collectors. A.A.Sfeir (Dept. of Mech. Engng., American Univ. of Beirut, Beirut, Lebanon).
Sol. Energy (USA), vol.30, no.5, p.397-9 (1983).
Monthly average optical efficiencies of flat plate collectors are expressed analytically in terms of the incidence angle modifier coefficient and geometric factors involving ratios of irradiations on plane of collector to irradiation to a simple expression similar to the equation used to compute the irradiation incident on the collector. The monthly average error introduced by the

approximate form of $\eta_0(\theta)$ is less than 1 per cent for all collector orientations and inclinations used in practice. (5 refs.)

73474 Empirical equations for calculation of CPC collector loss coefficients. C.K.Hsieh (Mech. Engng. Dept., Univ. of Florida, Gainesville, FL, USA), F.M.Mei.
Sol. Energy (USA), vol.30, no.5, p.487-9 (1983).
Presents empirical equations to analyse the thermal efficiency of compound parabolic concentrator collectors because it is a much simpler method than the analytic methods available which entail the simultaneous solution of nonlinear equations. (7 refs.)

73475 Comments on 'Critical thickness of a square section'. C.K.Hsieh.
Sol. Energy (USA), vol.30, no.5, p.491-2 (1983). (2 refs.)

73476 A parametric study on solar ponds. Y.F.Wang, A.Akbarzadeh (Dept. of Mech. Engng., Univ. of Melbourne, Parkville, Victoria, Australia).
Sol. Energy (USA), vol.30, no.6, p.555-62 (1983).
A linear relation between the efficiency of solar ponds and factor $\theta_d/\bar{H}$ which is the temperature difference between the pond bottom and the ambient divided by the average insolation is presented. This relation, which has been developed based on a steady state analysis provides valuable information on the relative importance of the parameters involved in the operation of solar ponds. It is found that the existence and the thickness of the top convective zone has a profound negative effect on the yield of solar ponds. The optimum thickness of the density gradient layer under various conditions is also presented. The effect of ground losses is discussed, and it is shown that for the case of wet soil, especially if the level of the underground water is high, the pond should be thermally insulated. It is also shown that the steady state analysis can predict with good accuracy the yearly average response of solar ponds under transient conditions. (18 refs.)

73477 Thermal model of a cylindrically symmetric solar pond. K.Dhingra, H.C.Bryant (Dept. of Phys. & Astron., Univ. of New Mexico, Albuquerque, NM, USA).
Sol. Energy (USA), vol.30, no.6, p.589-95 (1983).
A finite element heat transport program has been modified to model the thermal behavior for a cylindrically symmetric salt gradient polar pond of the Rabl-Nielsen type. In this model transient phenomena as well as steady state behavior can be studied. Results are presented for a model of the solar pond at the University of New Mexico and are compared with actual measurements. (15 refs.)

73478 Optimal control of solar heating and off-peak energy storage installations. C.B.Winn, R.C.Winn (Dept. of Mech. Engng., Colorado State Univ., Fort Collins, CO, USA).
Trans. ASME. J. Sol. Energy Eng. (USA), vol.105, no.1, p.50-7 (Feb. 1983).
It is well known that the widespread use of solar heating or cooling systems could lead to an increase in the cost of supply of power by the electric utilities. However, it is also recognized that by using appropriate control strategies in these systems the cost of supply may be reduced relative to that of electric resistance heating systems. Control strategies for solar heating systems and for off-peak heat storage systems have been developed and investigated in terms of utility cost of supply for the year 1990. This paper includes a discussion of results obtained for off-peak storage systems, solar heating systems, and combined solar and off-peak systems for the area served by Public Service Co. of New Mexico. (3 refs.)

73479 Appropriate sizing of solar heating systems. P.Bendt (Solar Energy Res. Inst., Golden, CO, USA).
Trans. ASME. J. Sol. Energy Eng. (USA), vol.105, no.1, p.66-72 (Feb. 1983).
It is generally assumed that a solar heating system should be sized by minimizing its life-cycle cost. This study shows, however, that the uncertainty in future economic trends makes the results of such a procedure questionable. The design conditions for minimum cost are extremely broad and all practical systems have a solar fraction within the limited range of 30 to 90 percent. Thus, by choosing only three collector areas that give systems within this range, one is assured of selecting a nearly optimal system for any realistic economic scenario. Selecting one of these three systems is essentially equivalent to economic optimization, but simpler. Procedures are derived in this paper for determining the sizes of the three systems. The conclusion is that the collector areas should be about 1/8, 1/5, and 1/3 of the building floor area. This rule of thumb eliminates the need to design solar systems individually, allowing the possibility of mass-produced homes with standardized solar heating systems. (2 refs.)

The CSI 1000 W lamp as a source for solar radiation simulation ....See Entry 71211

A comparison on the stability of horizontal fluid layers with radiative heat generation for two and three porous plates ....See Entry 71340

Climatic predispositions of Yugoslavia for solar energy application ....See Entry 73414

Stationary nonimaging concentrator as a second stage element in tracking systems ....See Entry 73424

86.40 ENERGY STORAGE (SECONDARY ENERGY)

86.40F Storage in thermal energy

73480 Latent heat storage material. T.Wada, K.Matsunaga, F.Kimura, R.Yamamoto, T.Kusuda, Y.Ise (Central Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.58-68 (Feb. 1983). In Japanese.
The authors have succeeded in preparing a new practical latent heat storage material consisting of sodium acetate trihydrate (melting point: 58°C, heat of fusion: 340 J/cm^3) as a main component, through solving the two difficult problems of supercooling and phase separation which are encountered in applying salt hydrates for latent heat storage. Practically, the crystal nucleation catalyst for sodium acetate trihydrate, sodium acetate trihydrate melt from supercooling, and the thickener mainly consisting of polyvinyl alcohol preventing thermal capacity of sodium acetate trihydrate from decreasing with cycling have been developed. This new latent heat storage material keeps working stably after 1000 thermal cycles. Further, it is found that urea lowers the melting point of sodium acetate trihydrate without decreasing its heat of fusion significantly. The eutectic mixture of the pseudobinary system $CH_3CO_2Na\text{-}3H_2O\text{-}CO\ (NH_2)_2$ (eutectic point: 31.5°C, heat of fusion, 292 J/cm^3) is well suited for storing low temperature heat such as solar energy in winter. (28 refs.)

73481 A simple computer program to model three-dimensional underground heat flow with realistic boundary conditions. P.D.Metz (Solar & Renewables Div., Brookhaven Nat. Lab., Upton, NY, USA).
Trans. ASME. J. Sol. Energy Eng. (USA), vol.105, no.1, p.42-9 (Feb. 1983).
A FORTRAN computer program called GROCS (Ground Coupled Systems) has been developed to study three-dimensional underground heat flow. Features include the use of up to 30 finite elements or 'blocks' of earth which interact via finite difference heat flow equations and a subprogram which sets realistic time and depth-dependent boundary conditions. No explicit consideration of moisture movement or freezing is given. GROCS has been used to model the thermal behavior of buried solar heat storage tanks (with and without insulation) and serpentine pipe fields for solar heat pump space conditioning systems. The program is available independently or in a form compatible with specially written TRNSYS component TYPW subroutines. This paper first describes the approach taken in the design of GROCS, the mathematics contained and the program architecture. Then, the operation of the stand-alone version is explained. Finally, the validity of GROCS is discussed. A companion paper serves as a user's guide to the TRNSYS compatible subroutine version. (27 refs.)

Optimal control of solar heating and off-peak energy storage installations ....See Entry 73478

Appropriate sizing of solar heating systems ....See Entry 73479

86.40H Storage in chemical energy

Energy storage in a fuel cell with bipolar membranes burning acid and hydroxide ....See Entry 73432

86.40K Hydrogen storage and technology

73482 Reaction furnace for hydrogen production. J.Kohoutek, M.Seidl, M.Odstrcil.
Czech. Heavy Ind. (Czechoslovakia), no.4, p.33-7 (1983).
Describes the design of a reaction furnace for hydrogen production. The radiation chamber is designed as a multi-row one with ceiling burners and exhaust of the combustion products through tunnel arranged in the bottom between the rows of tubes. The outlet header system is mounted on bearings permitting expansion in all directions. This design reduces the bending stress of the reaction tubes from the expansion movements. (no refs.)

73483 Metal hydride energy-technological treatment of hydrogen. S.S.Solovei.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.3, p.77-80 (1983). In Ukrainian.
An external and internal irreversibility of the compression cycle for heat utilization effectiveness in a metal hydride heat power installation is analyzed. Properties of a working fluid and also the design of metal hydride elements are shown to affect the thermodynamic performance of the heat power installation for hydrogen power processing. (4 refs.)

73484 The effect of glucose concentration and pH on hydrogen production by Rhodopseudomonas sphaeroides VM 81. A.Margaritis, J.Vogrinetz (Chem. & Biochem. Engng., Univ. of Western Ontario, London, Ontario, Canada).
Int. J. Hydrogen Energy (GB), vol.8, no.4, p.281-4 (1983).
The anaerobic photosynthetic bacterium Rhodopseudomonas sphaeroides was used to produce hydrogen gas from glucose. Light served as an energy source for the bacterium to synthesize ATP through photosynthetic phosphorylation. A new strain was developed R. sphaeroides VM81 through successive culturing and adaptation to glucose growth, which gave high yields and rates of hydrogen production. This paper reports optimization experiments on the growth and hydrogen production of R. sphaeroides VM81 at different initial glucose concentrations and pH. The optimum conditions for cell growth and hydrogen gas production were found to be at 7 g glu/l and pH=7.2. (13 refs.)

73485 Cost-effective methods for hydrogen production. R.G.Minet, K.Desai (Kinetics Technol. Internat. Corp., Pasadena, CA, USA).
Int. J. Hydrogen Energy (GB), vol.8, no.4, p.285-90 (1983).
Hydrogen is the key element in the upgrading processes for heavy oils, synthetic fuels, oil shale, tar sands and unconventional raw materials for liquid fuels preparation. Producing hydrogen in bulk from various hydrocarbon feedstocks requires serious evaluation of alternate processing routes to determine the most favorable economic impact on the overall system. This paper discusses several commercially proven systems for large-scale hydrogen plants including partial oxidation of heavy feedstocks, steam reforming combined with several options such as wet system processing, Pressure Swing Adsorption, high and low temperature shift, and the influence of product purity. The comparisons include process descriptions, operating cost factors and overall efficency evaluations. (4 refs.)

73486 The hydrogen economy: future policy implications. L.A.Slotin (Ministry of State, Sci. & Technol., Ottawa, Ontario, Canada).
Int. J. Hydrogen Energy (GB), vol.8, no.4, p.291-4 (1983).
The acceptance of hydrogen as a viable energy option has ramifications which go far beyond the scientific and technical. Consistency with national goals, legal, social and environmental consequences and the implications for the entire energy resource base are some of the aspects which must be carefully considered in pursuing hydrogen as an energy option. (no refs.)

73487 Ti-Mn alloy hydrides and their applications. T.Gamo, Y.Moriwaki, N.Yanagihara, T.Iwaki (Central Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.78-92 (Feb. 1983). In Japanese.
Already developed Ti-Mn alloys are expected to be used as hydrogen storage and transportation materials due to their features of low cost and large hydrogen capacity. Concerning the hydrogen absorption-desorption cyclic degradation properties, the hydrogen purification effect and hydriding (or dehydriding) reaction speed of Ti-Mn based hydrides, a major systematic study has been attempted from the viewpoint of use. As a result, the following properties have been obtained: the degradation of hydrogen capacity is only 30% for Ti-Mn binary alloy and 20% for Ti-Mn multicomponent alloys after approximately 10000 cycles. The purity of the hydrogen released from Ti-Mn alloy hydrides easily exceeds 99.9999% in comparison with 99.99% of introduced commercial grade hydrogen; the hydriding (or dehydriding) reaction speed is more than 500 ml/g.min. These results prove that Ti-Mn alloys are superior to known hydrides, Ti-Fe alloys and rare earth alloys, in not only the fundamental material properties but also in the practical characteristics. (19 refs.)

CANDU with hydrogen ....See Entry 70722

Hydrogen as a fuel ....See Entry 73400

86.70 ENVIRONMENTAL SCIENCE

(see also 87.60R Radioactive pollution; for oceanographic aspects, see 92.10; for hydrological aspects see 92.40; for meteorological aspects see 92.60)

Radiation influence on the surroundings in the case of accidential gaseous releases in nuclear power plant ....See Entry 70718

86.70C Soil

Spectrophotometric determination of micro amounts of nitrite in water and soil ....See Entry 73392

86.70E Water

73488 The geochemistry of plutonium in fresh and marine water environments. E.R.Sholkovitz.
Earth-Sci. Rev. (Netherlands), vol.19, no.2, p.95-161 (April 1983).
The chemical behaviour of plutonium in the hydrosphere is a subject of both great practical and intrinsic importance. The objective of the paper is to provide a synthesis and critical examination of currently published data and interpretations on the geochemistry of Pu in natural waters and sediments. Where appropriate, an attempt is made to reinterpret published data with the aim of establishing the relationships between geochemical and biological processes and the distribution, concentration and speciation of Pu. Particular attention is paid to the question of the potential for the chemical remobilization of Pu from the solid to the aqueous phase. Approximately one-third of the text deals with freshwaters (mostly lakes) while two-thirds discusses the estuarine, coastal and open ocean environments. (147 refs.)

73489 Dispersion of suspended matter in a homogeneous water flow. O.I.Samsonov (Moscow Inst. of Water Transport Engrs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.64-71 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.82-90 (1982).
The possibility of using two-dimensional and one-dimensional equations of conservation of suspended matter for numerical analysis of the dispersion of suspended matter in homogeneous flows is discussed. It is observed that little work has been done on calculation of suspended-matter distributions with allowance for exchange of sediment between the flow and the bottom of the basin. A modified procedure is proposed for calculating the dilution of effluents in projecting the distribution of fine fractions of soil stirred up in dredging operations. (20 refs.)

73490 Transport of phosphorus in surface runoff as influenced by liquid and solid fertilizer phosphate addition. A.N.Sharpley (Southern Plains Watershed & Water Quality Lab., USDA-AR, Durant, OK, USA).
Water, Air & Soil Pollut. (Netherlands), vol.19, no.4, p.321-6 (May 1983).
The effects of superphosphate applied as a liquid or a solid, on the transport of dissolved and particulate P in surface runoff from established pasture were evaluated using the field plots and natural rainfall. An approximately 3-fold increase in the transport of both dissolved inorganic P and particulate *P* in surface runoff was measured in 14 weeks following fertilizer application in the solid form (2.9 and 2.9% of the applied fertilizer P, respectively) compared to the liquid application (1.0 and 1.1% of the applied fertilizer P, respectively). In addition, the application of solid fertilizer P had a more sustained effect on the concentration of both dissolved and particulate P in surface runoff. The results are discussed. (18 refs.)

73491 Macrobenthos of Lake Naini Tal (UP, India) with particular reference to pollution. P.K.Gupta, M.C.Pant (Dept. of Zoology, Kumaun Univ., Naini Tal, India).
Water, Air & Soil Pollut. (Netherlands), vol.19, no.4, p.397-405 (May 1983).
The important attributes of macrobenthic community struture , namely species composition and number, population density, biomass and dominance and diversity indices were measured at different depths and discussed in relation to pollution of Lake Naini Tal. The zone below 7 m depth, where anoxic conditions prevailed for most part of the year, showed complete absence of macrobenthos. (16 refs.)

Considerations for waste conditioning associated with near-field phenomena and geochemical processes in a geological disposal environment ....See Entry 70686

Determination of trace amounts of phosphate in river water by flow-injection analysis ....See Entry 73391

Spectrophotometric determination of micro amounts of nitrite in water and soil ....See Entry 73392

86.70G Atmosphere

73492 Aromatic diesel emissions as a function of engine conditions. T.E.Jensen, R.A.Hites (Dept. of Chem., Indiana Univ., Bloomington, IN, USA).
Anal. Chem. (USA), vol.55, no.4, p.594-9 (April 1983).
The abundance and distribution of the alkyl homologues of polycyclic aromatic hydrocarbons (naphthalene, fluorene, phenanthrene, pyrene, fluoranthene, and phenylnaphthalene) and oxygenated polycyclic aromatic hydrocarbons (naphthalenecarboxaldehydes, fluoren-9-one, biphenylcarboxaldehydes, phenanthrenecarboxaldehydes and thioxanthen-9-one) in the organic extractables of particulates produced by a diesel engine are reported. Samples were obtained at three engine loads and at three fuel injection timing conditions. The concentrations of alkyl homologues of PAH and oxy-PAH on the particulates were found to decrease as cylinder exhaust temperature increased. The degree of alkylation for the most abundant homologue of these compounds increased by one to two carbons as the cylinder exhaust temperature was decreased. (23 refs.)

73493 Determination of oxygenated polycyclic aromatic hydrocarbons in airborne particulate matter by capillary gas chromatography and gas chromatography/mass spectrometry. J.Konig, E.Belfanz, W.Funcke, T.Romanowski (Fraunhofer-Inst. fur Toxikologie und Aerosolforschung, Munster-Roxel, Germany).
Anal. Chem. (USA), vol.55, no.4, p.599-603 (April 1983).
By use of a two-step column chromatographic separation of crude extracts from airborne particulate matter, a special fraction was separated which contained mainly oxygenated polycyclic aromatic hydrocarbons (OXPAH). The analysis was made by capillary gas chromatography (GC) and capillary gas chromatography/mass spectrometry (GC/MS). A total of 38 individual compounds belonging to five different groups of substances (ketones, quinones, anhydrides, coumarines, and aldehydes) were characterized by their retention indexes and mass spectra. (36 refs.)

73494 HCl in rocket exhaust clouds: atmospheric dispersion, acid aerosol characteristics, and acid rain deposition. G.L.Pellett, D.I.Sebacher, R.J.Bendura, D.E.Wornom (NASA, Langley Res. Center, Hampton, VA, USA).
J. Air Pollut. Control Assoc. (USA), vol.33, no.4, p.304-11 (April 1983).
Examines Space Shuttle launch impacts. Solid rocket exhaust includes ~60 tons HCl and ~87 tons alumina particles emitted below 2.5 km, of which 50-80% forms an altitude stabilized exhaust cloud (EC). Several 60% smaller Titan-III EC were sampled by aircraft for this study. Three distinct features are presented: (a) An analysis of HCl (gaseous plus aqueous) data traces. (b) An analysis of simultaneous HCl (g), HCl (g+aq) data for 2 EC. (c) An analysis of wet deposition after EC interception at ~30 min by a convective storm. (30 refs.)

73495 Scattering of radiation by particles in low-altitude plumes. R.B.Lyons (Centre for Electro-Optical Studies, Aerodyne Res. Inc., Billerica, MA, USA), J.Wormhoudt, J.Gruninger.
J. Spacecr. & Rockets (USA), vol.20, no.2, p.189-92 (March-April 1983).
The exhaust flowfields of solid propellant missiles may contain substantial amounts of alumina or other particles that scatter photons and, therefore, influence the radiation transport processes in such plumes. The authors study the modification of the aspect angle dependence of the plume radiation signature, especially close to nose-on viewing when particle scattering is included. Two calculational techniques were used to model radiation transport in missile exhaust plumes: the single scattering algorithm incorporated into the existing radiation code and a Monte Carlo simulation. The Monte Carlo simulation can provide as exact a solution to any specified radiative transfer problem as finite computation time will allow; however, it has been restricted to plumes modeled as a single cylinder with uniform concentration and temperature. The ARC formulation, on the other hand, is accurate only if multiple scattering is negligible, but provides fast estimates of radiation, including particle scattering in both simple plume models and complete missile exhaust flowfields. The Monte Carlo calculations serve to test the accuracy of the single-scattering model. (9 refs.)

73496 Acid rain deposition patterns in the continental United States. J.Wisniewski (Flow General Inc., McLean, VA, USA), E.L.Keitz.
Water, Air & Soil Pollut. (Netherlands), vol.19, no.4, p.327-39 (May 1983).
Acid rain has become a major environmental concern, the current extent of which is illustrated. Maps of both pH and H^+ deposition in precipitation are developed for the continental United States by analyzing laboratory pH data from nine precipitation chemistry networks and two single stations spread across the continental United States and southern Canada during the late 1970s. Average laboratory pH values are obtained or calculated for approximately 100 stations, and isopleths of weighted mean pH and mean annual H^+ deposition in precipitation were drawn. (28 refs.)

73497 Heavy metal and sulphur concentrations in Sphagnum magellanicum Brid. in the Maritime Provinces, Canada. K.E.Percy (Canadian Forestry Service, Dept. of the Environment, Fredericton, NB, Canada).
Water, Air & Soil Pollut. (Netherlands), vol.19, no.4, p.341-9 (May 1983).
A regional survey of selected heavy metals and S concentrations in Sphagnum magellanicum Brid. was completed within the Maritime Provinces, Canada. The concentrations of Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, S, and Zn were used to describe regional atmospheric deposition patterns to the terrestrial surface. There are measurable inputs of all elements. The elements were accumulated in the order S>Fe>Mn>Zn>Pb>Cu>Ni>Cr>Co>Hg>Cd. (24 refs.)

73498 The problem of aliasing in inferring long-range air pollution transport to Mauna Loa, Hawaii. M.Darzi, J.W.Winchester (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA).
Water, Air & Soil Pollut. (Netherlands), vol.19, no.4, p.407-9 (May 1983).
Choice of sampling strategy or criteria for selection of aerosol concentration data from a time series record can lead to errors in estimating periodic regularities because of aliasing. By means of an example from Mauna Loa Observatory during spring dust transport from Asia, it is shown that the detection of possible transport of pollution S across the Pacific to Hawaii could be missed through inadvertent aliasing errors. (5 refs.)

Chemistry of the Unpolluted and Polluted Troposphere. Proceedings of the NATO Advanced Study Institute ....See Entry 69791

Deposition of Atmospheric Pollutants. Proceedings of a Colloquium ....See Entry 69792

Atmospheric Turbulence and Air Pollution Modelling ....See Entry 69793

Spectrophotometric determination of atmospheric nitrogen monoxide and nitrogen dioxide after collection with [*N,N'*-ethylenebis(salicylideniminato)]cobalt ....See Entry 73381

Ozone measurements from a network of remote sites ....See Entry 73864

The composition of precipitation in remote areas of the World ....See Entry 73868

Chemical analysis of cloud water collected over Hawaii ....See Entry 73871

Magnitudes and sources of precipitation and dry deposition fluxes of industrial and natural leads to the North Pacific at Enewetak ....See Entry 73875

A study of atmospheric diffusion from the LANDSAT imagery ....See Entry 73883

Anomalies in temperature and rainfall during warm Arctic seasons ....See Entry 73905

86.70J Noise

(see also 43.50 Noise, its effects and control)

73499 Time-of-day corrections in measures of aircraft noise exposure. R.B.Bullen, A.J.Hede (Nat. Acoustic Labs., Millers Point, Australia).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1624-30 (May 1983).
Results of socio-acoustic study of human reaction to aircraft noise around Australian airports are described. The relative importance of night, evening, and daytime operations in determining overall reaction is assessed using a correlation analysis procedure. The results indicate that night-time weightings used in most existing noise exposure indices including NEF and DNL, are too large. However, other evidence suggests that both night and evening weightings should be greater than 0 dB. The optimal weightings found were about 3 dB for night-time operations and 9 dB for evening operations. However, other considerations indicate that in a practical noise index it may be more reasonable to apply a weighting of about 6 dB during both night and evening hours. (13 refs.)

Analysis of low frequency sound radiating from bridge by a travelling vehicle .... See Entry 71296

Traffic noise annoyance and noise sensitivity in persons with normal and impaired hearing .... See Entry 73599

Traffic noise annoyance and speech intelligibility in persons with normal and persons with impaired hearing .... See Entry 73600

86.70L Measurement techniques in environmental science

73500 **SnO_2 sputtered film gas sensor.** T.Sotomura, K.Ariga, S.Sekido (Central Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Natl. Tech. Rep. (Japan), vol.29, no.1, p.137-44 (Feb. 1983). In Japanese.
Through a high temperature heating process at 600°C, a SnO_2 thin film formed by a sputtering technique has been obtained with high gas-sensing characteristics. It provides a promising means for detecting the hazardous NO_2 contamination in urban environments. The device can also be used for warning of an oxygen deficient air condition, which is characterized by a low oxygen content of 18 to 19% and a high CO gas content of 10~1000 ppm. The gas-sensing device, furthermore, makes full use of its real ability when it detects an exhaust gas in which there are both reducing gases, such as CO, and oxidizing gases, such as O_2 and NO_2. Placed in the exhaust of a conventional fossil-fuel burning appliance, this sensor detects the most suitable point of combustion for fuel consumption. (7 refs.)

Laser processing and analysis of materials .... See Entry 69807

Determination of trace amounts of phosphate in river water by flow-injection analysis .... See Entry 73391

Spectrophotometric determination of micro amounts of nitrite in water and soil .... See Entry 73392

The ERS-1 programme of the European space agency .... See Entry 73967

86.70Z Other topics

73501 **Nuclear waste repository characterization: a spatial estimation/identification approach.** J.V.Candy, Nai-hsien Mao (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.191-200 (April 1983).
The authors consider the application of spatial estimation techniques to groundwater aquifer and geological borehole data. The adequacy of these techniques to reliably develop contour maps from various data sets is investigated. The estimator is developed theoretically in a simplified fashion using vector-matrix calculus. The practice of spatial estimation is discussed and the estimator is then applied to a groundwater aquifer system and a deep geological formation. It is shown that the various statistical models must first be identified from the data and evaluated before reasonable results can be expected. (21 refs.)

73502 **Radionuclide transport processes in terrestrial ecosystems.** F.W.Whicker (Dept. of Radiology & Radiation Biology, Colorado State Univ., Fort Collins, CO, USA).
Radiat. Res. (USA), vol.94, no.1, p.135-50 (April 1983).
Some major principles and the status of knowledge concerning the transport of radionuclides through terrestrial ecosystems are reviewed. Fundamental processes which control the flow of radionuclides between ecosystem components such as air, soil, plants, and animals are described, with emphasis on deposition, resuspension, plant uptake, ingestion, and assimilation. Properties of radionuclides, organisms, and ecosystems are examined in relation to their influence on the accumulation of radioactive materials by plants and animals. The effects of the physicochemical nature of the radionuclide; morphology, physiology, and behavior of the organism; and soil, nutrient, and trophic characteristics of the ecosystem are highlighted. Observations in natural ecosystems on radionuclides such as ^{137}Cs, ^{90}Sr, ^{131}I, ^{3}H, and ^{239}Pu are used to illustrate current concepts. An assessment of the degree to which the processes controlling radionuclide behavior are understood and of one's ability to simulate and predict such behavior with computerized models is offered. Finally, brief comments are made on research needs. (47 refs.)

73503 **A contribution to the theory of anthropogenic effects on local meteorological processes in a city.** M.E.Beryland, M.N.Zashikhin (Main Geophys. Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.1-10 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.5-16 (1982).
The changes in the meteorological regime of cities that result from air pollution, urban construction, changes in the nature of heat and moisture exchange, and the release of heat as a result of human economic activity are the subject of a theoretical investigation. The studies are based on the numerical solution of a system of motion, heat- and moisture-input, and radiation-transfer equations including the variations of the underlying-surface radiation balance over the day and the influence of the surface airflow from the environs of the city. Analysis of the calculations makes it possible to consider problems of heat-island formation in the city and to investigate the way in which the diurnal variations of air temperature, wind velocity, and the exchange coefficient differ between the city and its environs, as well as the formation of radiation fogs and their interaction with the heat island. (19 refs.)

73504 **Inadvertant effect of large cities and industrial centers on precipitation.** I.V.Litvinov.
Sov. Meteorol. & Hydrol. (USA), no.3, p.92-102 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.111-19 (1982).
The literature data on changes in the intensity of precipitation-formation processes and total precipitation in the region of large cities and industrial centers are examined. The possible causes of these changes are discussed and it is shown that the structure of urban buildup and heat liberation has the main effect. (89 refs.)

87.00 BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

87.10 GENERAL, THEORETICAL, AND MATHEMATICAL BIOPHYSICS

(inc. logic of biosystems, quantum biology, and relevant aspects of thermodynamics, information theory, cybernetics, and bionics)

73505 **The measurement accuracy required for acceptable estimation of steady and non-steady rates of appearance and disappearance from the inaccessible compartment of an open, two-compartment system.** R.Wootton (Radioisotopes Div., MRC Clinical Res. Centre, Harrow, England).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.141-9 (May 1983).
A two-compartment system for measuring non-steady state turnover rates was examined by computer simulation. Tracee appears de novo in a compartment to which the experimenter has no access, and from which material is irreversibly lost. In the steady state, Monte Carlo analysis showed that the compartment sizes and fluxes could be determined by tracer experiments with reasonable accuracy. In contrast, under non-steady state conditions, the results proved extremely sensitive to observational uncertainties. Given perfectly accurate input data, simulation showed that the calculated turnover rates agreed closely with the true answer, although not perfectly because of the necessity for interpolation. Contaminating the input data with a single erroneous observation of either tracee or tracer concentration produced large, spurious oscillations in the calculated turnover rates, the duration of which was inversely proportional to the frequency with which the infused compartment was sampled. Contaminating the input data with observational noise of a magnitude likely in practice so degraded the results that they became almost unuseable. It is concluded that non-steady state measurements are feasible using this model, but that rapid sampling and random uncertainties smaller than 1% (coefficient of variation) are desirable in the measurement of tracer and tracee concentration. (11 refs.)

73506 **Theorems on amplification of fluctuations and their biological implications.** Huang Wi-tze (Inst. of Biophys., Acad. Scinica, Beijing, China).
Commun. Theor. Phys. (China), vol.1, no.1, p.87-95 (1982).
Three theorems are proposed: (1) Amplification of a fluctuation is possible within a closed system. (2) The second-order time derivative of Boltzmann's H-quantity may contain terms of negative value. (3) An H-theorem for open systems. Nonsimilarity is also a fundamental reason why phenomena defying the thermodynamic law in an apparent way (such as life) exist in the course of evolution. It is speculated that certain key biomolecules such as ATP are situated at long lifetime excited states, thus at states far from thermal equilibrium. The biomolecules are large fluctuations produced or amplified during a relaxation process starting from an extreme initial state, and stabilized by solar radiation. (10 refs.)

73507 **Mossbauer absorption in overdamped harmonically bound particles in Brownian motion.** I.Nowik, S.G.Cohen, E.R.Bauminger, S.Ofer (Racah Inst. of Phys., Hebrew Univ., Jerusalem, Israel).
Phys. Rev. Lett. (USA), vol.50, no.19, p.1528-31 (9 May 1983).
Recent Mossbauer studies of ^{57}Fe in a variety of biological systems, including proteins and membranes, reveal absorption spectra consisting of a narrow 'elastic' part and a wide 'inelastic part'. These results are interpreted by a model of bounded diffusion in which overdamped harmonically bound particles are in Brownian motion. Excellent fits to experimental data are obtained, which yield values of the mean square displacement $\langle x^2 \rangle$ and diffusion coefficient D of the particles. (14 refs.)

The development of a system theory for telecommunications, optics and cybernetics .... See Entry 71081

Stochastic fluctuations in a dynamic system modelling macroscopic activity of nerve tissues .... See Entry 73554

Sudden cardiac death: a problem in topology .... See Entry 73560

Development of a rheological constitutive relation for a soft biological tissue .... See Entry 73617

87.15 MOLECULAR BIOPHYSICS

(see also 36.20 Macromolecules and polymer molecules)

73508 **Conformational dynamics of proteins and elementary molecular 'machines'.** K.V.Shaitan, A.B.Rubin (Biology Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.393-8 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.386-90 (1982).
The stochastic character of the dynamics of the macromolecules and the coupling of functional activity and conformational mobility of proteins are discussed. An equation is obtained and solved describing the work of a very simple molecular 'machine' which may also be interpreted as an equation of motion for the conformon. (13 refs.)

73509 **Thermodynamic parameters characterizing the interaction between the ligand molecules adsorbed on a polymer.** Yu.D.Nechipurenko (Inst. of Molecular Biology, Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.398-406 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.391-8 (1982).
A procedure is worked out for finding the potentials of paired interactions between the ligand molecules adsorbed on a polymer. A method is proposed for describing such interactions with the aid of the potentials of the simple forms—rectangular and trapezoidal. It is shown that if the interactions spread over distances much larger than the mean distances between the adsorbed molecules adsorption is described by an equation characteristic of noncooperative binding of ligands. On this basis the author develops a method of analysing the experimental adsorption isotherms enabling one to determine the energy of interaction between the adsorbed ligand molecules and the characteristic distance over which such interactions spread. This method is used to analyse the experimental adsorption isotherms of the antibiotic distamycin A on poly(dG).poly(dC). (11 refs.)

73510 **Adsorption of tRNA on silicone-coated porous glass.** T.Mizutani (Faculty of Pharmaceutical Sci., Nagoya City Univ., Nagoya, Japan).
J. Non-Cryst. Solids (Netherlands), vol.55, no.1, p.173-7 (April 1983).
The adsorption of tRNA and composites in a highly concentrated NaCl solution on the hydrophobic silicone-coated porous glass was investigated. The amounts of nucleic acids adsorbed on the column were measured from the difference between the concentration of nucleic acids in the solution applied on the column and the eluent from the column, according to the method of

Messing (1976). Column volume was determined by the elution of Bromphenol blue solution. (13 refs.)

73511 On the dispersion forces between molecules in an active medium. W.L.Schaich (Phys. Dept., Indiana Univ., Bloomington, IN, USA).
Phys. Lett. A (Netherlands), vol.95A, no.2, p.124-6 (18 April 1983).
The theoretical analysis by Frohlich (1972) and by Genzel (1978) of a medium's influence on the dispersion forces between molecules is criticized. A corrected treatment is given for some model systems. No anomalies are apparent. (13 refs.)

73512 Headgroup interactions in mixed phospholipid bilayers. F.Sixl, A.Watts (Biochem. Dept., Univ. of Oxford, Oxford, England).
Proc. Natl. Acad. Sci. USA, vol.80, no.6, p.1613-15 (March 1983).
^{2}H NMR methods have been used to study how bilayer-forming phospholipids interact with each other at the membrane surface. Aqueous dispersions of dimyristoyl-sn-phoshatidylcholine (Myr$_2$-PtdCho), dimyristoyl-sn-phosphatidylethanolamine (Myr$_2$-PtdEtn), and dimyristoyl-sn-phosphatidyl-3-glycerol, specifically deuterated at different positions in their headgroups, give well-resolved ^{2}H NMR powder spectra. These spectra are characteristic of a lipid bilayer with quadrupole splittings that are sensitive to the amplitude of headgroup motion. In binary mixed bilayers of deuterated lipids with an unlabeled component, all parts of the deuterated headgroup monitor the presence of the second lipid from changes in the measured quadrupole splittings. The headgroups of the charged lipids, dimyristoyl-sn-phosphatidylserine and dimyristoyl-sn-phosphatidyl-3-glycerol, interact to the largest extent with the choline moiety of Myr$_2$-PtdCho and the ethanolamine moiety of Myr$_2$-PtdEtn, whereas a somewhat smaller but still marked alteration in headgroup motion was observed in Myr$_2$-PtdCho/Myr$_2$-PtdEtn mixtures. The large changes in the deuterium quadrupole splittings for the zwitterionic lipids after addition of a charged lipid suggest that either a strong perturbation in the hydrogen bonding occurs or changes take place in the water structure at the membrane surface, or possibly both. (15 refs.)

Theorems on amplification of fluctuations and their biological implications ....See Entry 73506

Electromechanical and physicochemical properties of connective tissue ....See Entry 73624

87.15B Structure, configuration, conformation, and active sites at the biomolecular level

73513 Configurations of the carotenoid in carotenoproteins from Rhodospirillum rubrum. A resonance Raman study. M.Kito (Faculty of Sci., Kwansei Gakuin Univ., Nishinomiya, Japan), J.Yamashita, Y.Koyama.
Photobiochem. & Photobiophys. (Netherlands), vol.5, no.4, p.209-17 (April 1983).
The resonance Raman spectra of carotenoproteins from Rhodospirillum rubrum were recorded. The carotenoid (spirilloxanthin) in the carotenoproteins showed two bands in the C=C stretching region, i.e. above 1500 cm^{-1}. The one whose frequency is lower (1508 cm^{-1}) and independent of the wavelength of the excitation line was attributed to the all-trans configuration. The other broad band, the frequency of which was 1543, 1536 and 1526 cm^{-1} at 457.9, 488.0 and 514.5 nm excitation, was attributed to an assembly of heterogeneous cis-configurations of the carotenoid. The two bands persisted separately at 1543 (457.9 nm excitation) and 1508 cm^{-1} immediately after rapid extraction of the carotenoid with hexane from the carotenoproteins. However, after keeping the extract overnight in the dark, they changed into a broad profile reaching a peak of 1509 cm^{-1} and having a tail at higher frequencies, which indicates a mixture of cis trans isomers in thermal equilibrium. Therefore, the configurations in the carotenoproteins which give rise to the two separate bands are considered to be stabilized by interaction with the apopeptide. The band at 1543 cm^{-1} appeared and increased in intensity relative to the 1508 cm^{-1} band during treatment of *R.* Rubrum chromatophores with sodium dodecyl sulfate and β-mercaptoethanol. Thus, the cis-configurations in the carotenoproteins are ascribable to the isomerization of the all-trans carotenoid in the solubilizing procedure. (16 refs.)

73514 Evidence for conformational substates of rhodopsin from kinetics of light-induced charge displacement. M.Lindau, H.Ruppel (Max-Volmer-Inst., Tech. Univ. Berlin, Berlin, Germany).
Photobiochem. & Photobiophys. (Netherlands), vol.5, no.4, p.219-28 (April 1983).
Fast electric photosignals with R1 and R2 component were measured in an artificial system formed by fragments of bovine rod outer segments. The kinetics of the R2 generating process could not be described simply by a single exponential function. Evidence is presented which shows that the time course of the R2 charge displacement $Q_d(t)$ should be described by the reciprocal power law $Q_d(t)=Q^\infty[1-(1+k^p.t/n)^{-n}]$ rather than by a sum of exponentials. This time course is interpreted as being due to a distribution of rhodopsin substates with different activation energies. The activation energy of the peak rate constant k^P as well as the absolute rate constants are in very good agreement with the time constants obtained for the meta I-meta II transition when treated as an average first order process. (19 refs.)

73515 Defect structures of the liotropic phases of phospholipids. Ye.V.Kononenko, O.A.Varshavskaya (Kirov Polytech. Inst., Sverdlovsk, USSR).
Biophysics (GB), vol.27, no.3, p.406-12 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.399-403 (1982).
The mutual link between defect structures and relaxation processes on formation of liotropic phases in various systems of phospholipids has been studied. It is shown that the character of the structural disturbances and the kinetics of the textural rearrangements and crystallization significantly depend on saturation of the fatty acid lipid residues. It has been established that the introduction of dimethyl sulphoxide increases by one order the time interval of the existence of the lipid mesophases. The textural rearrangements in all systems are initiated by disturbances of structure. (10 refs.)

73516 Study of the conformational stability of immunoglobulin G in monolayers at the phase boundary between aqueous NaCl and octane. L.V.Chasovnikova, N.A.Matveyeva, V.V.Lavrent'ev (Second Pirogov State Medical Inst., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.444-50 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.435-40 (1982).
The method of monomolecular layers has been used to study the resistance to surface denaturing of preparations of human and equine immunoglobulin G (IgG) at the separation boundary between aqueous NaCl solution and octane as a function of the pH of the aqueous solutin and the concentration of NaCl. It is shown that as compared with monolayers of these preparations at the aqueous NaCl solution-air phase boundary on a liquid to liquid surface of separation the IgG molecules possess high conformational stability. It was not possible to record disturbance of the native structure of the protein in the 2.8-8.0 pH interval of the aqueous solution at a NaCl concentration of 0.15 M. With increase in the content of NaCl from 0.15 M to 2.0 M at neutral pH the molecules of equine IgG also did not lose their native structure while the human IgG molecules were affected only to a weak degree by surface denaturing. (17 refs.)

73517 Conformational structure of respiratory mucus studied by laser correlation spectroscopy. P.Verdugo, P.Y.Tam, J.Butler (Dept. of Internal Medicine & Biological Structure, Univ. of Washington, Seattle, WA, USA).
Biorheology (GB), vol.20, no.2, p.223-30 (1983). (Proceedings of the Fourth International Congress of Biorheology, Tokyo, Japan, 27 July-1 Aug. 1981).
Samples of respiratory mucus were obtained from the trachea of dogs and patients undergoing bronchoscopy. The samples were studied by laser correlation spectroscopy. The autocorrelation function of laser light scattered by both human and canine respiratory mucus was a single exponential in thick mucus or a double exponential in thin watery mucus. This finding suggests that, as in the case of uterine cervical mucus, the molecular structure of respiratory mucus is an ensemble of entangled, randomly-coiled glycoproteins forming a loose network of variable density rather than a covalently cross-linked molecular network as proposed in earlier studies. (14 refs.)

73518 Concept of conformationally equivalent heminucleotides and its implications in the analysis of the folding of secondary and tertiary structures of nucleic acids. R.Malathi, N.Yathindra (Dept. of Crystallography & Biophys., Univ. of Madras, Madras, India).
Curr. Sci. (India), vol.52, no.2, p.53-7 (20 Jan. 1983).
The secondary structural features of double-stranded helices, both of poly (mononucleotide) as well as poly (dinucleotide) types are illustrated with the aid of distance diagonal plots using the recently developed heminucleotide scheme which affords a common basis for description and analysis of all conformations of nucleic acids. The types of interactions that characterise the major and minor grooves of nucleic acid helices the variations in their positions and widths, the minimum number of residues required for their occurrence etc. which follow as a direct consequence of variations in the sugar residue conformation (ψ,ψ^2) of the nucleotide and the internucleotide phosphodiester (ω',ω) are clearly manifested. These are relevant to an understanding of the possible mode of interactions of molecules like peptides, drugs, metal ions, water etc. in helical grooves of nucleic acids. (11 refs.)

73519 A hypothesis for a double helix in which the two polynucleotide strands intercalate instead of forming base-pairs. M.A.Viswamitra, J.Pandit (Dept. of Phys., Indian Inst. of Sci., Bangalore, India).
Curr. Sci. (India), vol.52, no.5, p.207-9 (5 March 1983).
A proposal is made for a double helical structure in which the two polynucleotide strands intercalate. The repeat unit consists of two nucleotides which show interstrand overlap instead of forming base-pairs. (10 refs.)

73520 The orientational dependence of paramagnetic Mossbauer spectra on a weak magnetic field. Investigations on a metmyoglobin single crystal. S.S.Yakimov, V.M.Cherepanov, M.A.Chuev, A.M.Afanas'ev, F.Parak (I.V. Kurchatov Inst., Moscow, USSR).
Hyperfine Interactions (Netherlands), vol.14, no.1, p.1-6 (April 1983).
Mossbauer experiments were performed on a single crystal of metmyoglobin at 4.2K. A small magnetic field was applied in different orientations. The results show the sensitivity of the Mossbauer spectra to the direction of the field. It was possible to detect the heme normal with respect to the orientation of the myoglobin crystal. (8 refs.)

73521 Transitions and molecular packing in highly purified 1,2-dipalmitoyl-phosphatidylcholine-water phases. I. Transitions, improved phase diagrams, method of packing analysis, molecular structures of diglyceride, and polar regions. N.Albon (Phys. des Liquides, Univ. de Provence, Marseille, France).
J. Chem. Phys. (USA), vol.78, no.7, p.4676-86 (1 April 1983).
Results of extensive studies of phases prepared from highly purified 1,2-dipalmitoyl-*sn*-phophatidylcholine and 1,2-dipalmitoyl-sn-glycerol are presented. The methods used included X-ray diffraction and thermal analysis and both temperature and water content were varied. An improved phase diagram was obtained from thermal data which showed well-defined transitions, and from discontinuities in a plot of bilayer repeat spacings with water content. For analysis of molecular packing the bilayer was divided into diglyceride and phosphorylcholine regions. The properties of the diglyceride regions of both compounds are discussed. Estimates of the size and shape of the polar groups are made and the general principles involved in their packing and the influence of water are discussed. Among new features reported, are the existence of the $0\perp$ close chain packing for the crystalline dipalmitoyl glycerol but not in any lecithin phase. Three single crystal lecithin phases with different water contents were prepared which are more stable than the hexagonal chain phases usually reported in the same regions. These hexagonal phases slowly recrystallize to more stable forms, but are usually obtained on cooling melts or higher temperature phases. The single crystal phases only exist over restricted composition ranges while phases with hexagonal, square, and disordered chain packing can accommodate a variation in water content by a tilt of the chain axes and changes in bilayer thickness. Transition widths vary and are extremely sensitive to impurities. (28 refs.)

73522 Soliton-like processes during right-left transition in DNA. P.Jensen (Inst. for Theoretical Phys., Freie Univ. Berlin, Berlin, Germany), M.V.Jaric, K.H.Bennemann.
Phys. Lett. A (Netherlands), vol.95A, no.3-4, p.204-8 (25 April 1983).
A salt induced right-left conformational change in DNA is discussed. A phenomenological model is presented for the transition in short DNAs. For long DNAs a microscopic model equation of motion is analyzed. Solitary-wave solutions are demonstrated and some experimental implications are emphasized. (17 refs.)

73523 Fibrinogen and fibrin structure and fibrin formation measured by using magnetic orientation. J.-M.Feyssinet (Inst. Nat. de la Sante et de la Recherche Medicale, Dept. de Recherche Fondamentale, Centre d'Etudes Nucleaires, Grenoble, France), J.Torbet, G.Hudry-Clergeon, G.Maret.
Proc. Natl. Acad. Sci. USA, vol.80, no.6, p.1616-20 (March 1983).
Accurate birefringence measurements show that fibrinogen orients to a small degree in high magnetic fields. This effect can be explained as due to the molecule having about 30% (by weight) α-helix oriented relatively parallel to the long axis. Birefringence measurements on fully oriented fibrin suggest that aligned α-helical content is less than that estimated for fibrinogen. But because of limitations in the analysis this difference must be viewed with caution. Highly oriented fibrin results when polymerization takes place slowly in a strong magnetic field. Low-angle neutron diffraction patterns from oriented fibrin made in the presence of EDTA, made in the presence of calcium, or stabilized with factor XIIIa are very similar, showing that the packing of the molecules within the fibers is the same or very similar in these different preparations. The induced magnetic birefringence was used to follow fibrin formation under conditions in which thrombin was rate limiting. The fiber network formed by approximately the gelation point constitutes a kind

of matrix or frame that is largely built upon during the remaining ≈85% of the reaction. After gelation the reaction is pseudo-first order. (31 refs.)

73524 A scanning electron microscopic study of winged twin crystals in the bean legume. M.J.Grimson, H.J.Arnott, M.A.Webb (Dept. of Biology, Univ. of Texas, Arlington, TX, USA).
Scanning Electron Microsc. (USA), pt.3, p.1133-40 (1982).
Kinked and straight twin crystals of calcium oxalate monohydrate found in the mesocarp of the common bean (Phaseolus vulgaris) are described. The crystals are found within a sheath and are therefore termed Rosanoffian crystals. Contact twinning occurs in the crystals by two general crystallographic laws, a mirror-image along a twin plane (kinked) and rotation about a twin axis (straight). The crystals appear to be a model monohydrate twin with a standard twinning plane and twinning angles indicative of the monohydrate. The apparent random distribution of kinked and straight crystals in the tissue suggests that the morphology at the twin plane (i.e., straight vs. kinked) is due more to random thermal influences early in crystal development than to direct genetic control. (29 refs.)

73525 Calcium oxalate (weddellite) crystals in forest litter. H.J.Arnott (Dept. of Biology, Univ. of Texas, Arlington, TX, USA).
Scanning Electron Microsc. (USA), pt.3, p.1141-9 (1982).
Forest litter samples from the Wasatch National Forest of Utah were studied by light and scanning electron microscopy and X-ray powder diffraction. Gymnosperm and aspen leaves in the litter have numerous hyphae growing on their surfaces. These white hyphae are covered with a plethora of needle-shaped crystals. The acicular crystals may reach a length of 22 μm and a diameter of 1 μm; they have a low white birefringence and show acid solubilities that are characteristic of calcium oxalate. By X-ray diffraction the crystals were identified as weddellite (calcium oxalate dihydrate). It was possible to find what appear to be stages in crystal development. The crystals develop inside the hyphae; they grow to an intermediate stage in which the ends cause the extension of the hyphal wall. Following this, the crystals become more and more external. Mature crystals become disassociated from the hyphae and sometimes collect in groups. (22 refs.)

Small-angle X-ray scattering from myosin heads in relaxed and rigor frog skeletal muscles .... See Entry 73530

Evidence for radiation-induced bulky lesions in DNA .... See Entry 73646

Determination of the size of blood lipoproteins by optical methods .... See Entry 73689

87.15M Interactions with radiations at the biomolecular level

73526 Kinetics of the primary stages of the photocycle of bacteriorhodopsin at low temperatures. B.V.Zubov, N.A.Sulikov, N.M.Chernavskaya, D.S.Chernavskii, I.V.Chizhov (Levedev Phys. Faculty, Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.363-8 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.357-61 (1982).
The kinetics of two primary stages of the photochemical cycle of bacteriorhodopsin has been studied from the changes in the absorption spectra over the temperature range 160-300K. It was found that for the transition $K_{610} \rightarrow L_{550}$ over the whole range studied the dependence of the rate on temperature is described by the Arrhenius law with the activation energy $E_a = 0.68$ eV. For the transition $L_{550} \rightarrow M_{412}$ the value $E_a = 0.69$ eV. The character of the temperature dependence of the rate and amplitude for this transition indicate that at $T \leq 210$K a phasic transition is possible. (14 refs.)

73527 Temperature dependence of the ^{1}H-n.m.r. spectrum of hydrated collagen. Yu.P.Meshalkin, S.P.Gabuda, A.F.Rzhavin (Novosibirsk State Medical Inst. of Inorganic Chem., Acad. of Sci., Novosibirsk, USSR).
Biophysics (GB), vol.27, no.3, p.381-6 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.375-9 (1982).
From analysis of the temperature dependence of the constant of spin-spin interaction (α) it is shown that at temperatures below 265K the probabilities of population of donor (S^+) and acceptor (S^-) adsorption centres on the surface of collagen are respectively $P(S^+) \leq 1/10$, $P(S^-) = 0$ and at temperatures 265-283K $P(S^+) < 1/30$, $P(S^-) = 0$. Above 283K the fine structure of the ^{1}H-n.m.r. spectra disappears, which is explained by the destruction of the clathrate-like structures of the hydrate sheath of protein. (7 refs.)

73528 Binding of Ca^{2+} ions by cow's milk α-lactalbumin: study based on changes in intrinsic protein fluorescence. Ye.A.Permyakov, V.V.Yarmolenko, L.P.Kalinichenko, L.A.Morozova, E.A.Burshtein (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.3, p.386-92 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.380-5 (1982).
The binding of one Ca^{2+} ion by a molecule of cow's milk α-lactalbumin produces a conformational change reflected in fall in the quantum yield of tryptophan fluorescence of protein and a heavy shift of its fluorescence spectrum to the shortwave side (by ~15 nm). This change may be interpreted as the result of the transfer of one or more surface tryptophan residues within the protein globule into the surroundings containing effectively quenching groups (possibly disulphide bonds). The binding content of Ca^{2+} by α-lactalbumin evaluated from the fluorimetric EGTA and pH titration is $(3\text{-}6) \times 10^8$ M^{-1}. The results obtained suggest that the well known conformational change in the molecule of α-lactalbumin for acid pH is due to the competitive ousting of bound Ca^{2+} by three protons ($pK = 5.0 \pm 0.1$). (17 refs.)

73529 Dielectric studies of sonicated egg yolk lecithin at around 800 MHz. G.S.Chana (Dept. of Phys., King's Coll., London, England), M.Y.Rosseneu, R.J.Sheppard, E.H.Grant.
J. Mol. Liq. (Netherlands), vol.25, no.2, p.103-7 (April 1983).
Dielectric studies have been carried out on aqueous solutions of sonicated egg yolk lecithin (EYL) at a frequency of around 800 MHz; these indicate the presence of water of hydration association with the vesicle. Assuming a simple mixture formula, calculations show that there are around 0.3 g of water of hydration for 1 g of the solute. (10 refs.)

73530 Small-angle X-ray scattering from myosin heads in relaxed and rigor frog skeletal muscles. F.R.Poulsen, J.Lowy (Oxford Res. Unit., Open Univ., Oxford, England).
Nature (GB), vol.303, no.5913, p.146-52 (12 May 1983).
Low-angle X-ray diffraction patterns from relaxed and nonoverlap rigor muscles show a central region of diffuse scattering (disk) which is circularly symmetrical, behaves as solution scattering and comes predominantly from myosin heads. In full-overlap rigor the disk is compressed in the diagonal direction, indicating that the moysin heads have a bent shape and a preferred orientation consistent with a 45° angle of attachment to actin. (37 refs.)

73531 Bathorhodopsin intermediates from 11-cis-rhodopsin and 9-cis-rhodopsin. J.D.Spalink, A.H.Reynolds, P.M.Rentzepis (Bell Labs., Murray Hill, NJ, USA), W.Sperling, M.L.Applebury.
Proc. Natl. Acad. Sci. USA, vol.80, no.7, p.1887-91 (April 1983).
Bathorhodopsin-rhodopsin difference psectra of native 11-cis-rhodopsin and regenerated 9-cis-rhodopsin were measured at room temperature with a double-beam laser psectrophotometer after excitation at 532 nm. A detailed analysis of data obtained at 85 psec after excitation suggests that the bathorhodopsins generated from 11-cis and 9-cis-rhodopsin differ in their extinction coefficients and that their absorption maxima are shifted in wavelength by about 10 nm from one another. The ratio of quantum yields for photochemical production of the 11-cis-bathorhodopsin and the 9-cis-bathorhodopsin approximates 1. Implications that the early photochemical processes in vision are more complex than previously considered are explored. (30 refs.)

Effects of cross relaxation on the analysis of T_1 data in paramagnetic proteins .... See Entry 70909

Configurations of the carotenoid in carotenoproteins from Rhodospirillum rubrum. A resonance Raman study .... See Entry 73513

Evidence for conformational substates of rhodopsin from kinetics of light-induced charge displacement .... See Entry 73514

Conformational structure of respiratory mucus studied by laser correlation spectroscopy .... See Entry 73517

The orientational dependence of paramagnetic Mossbauer spectra on a weak magnetic field. Investigations on a metmyoglobin single crystal .... See Entry 73520

Absence of the influence of a magnetic field on Na^+, K^+-dependent ATPase .... See Entry 73627

Evidence for radiation-induced bulky lesions in DNA .... See Entry 73646

Determination of the size of blood lipoproteins by optical methods .... See Entry 73689

87.16 BIOTHERMICS

Thermodynamic parameters characterizing the interaction between the ligand molecules adsorbed on a polymer .... See Entry 73509

Temperature dependence of the ^{1}H-n.m.r. spectrum of hydrated collagen .... See Entry 73527

Study of heat-induced structural rearrangements in the membranes and lipid of lyzosomes in experimental carcinogenesis .... See Entry 73535

Temperature characterization of oubaine-insensitive sodium flux in frog muscle .... See Entry 73550

The temperature dependency of neural and hair cell responses evoked by high frequencies .... See Entry 73591

Cochlear effects of cryosurgery .... See Entry 73602

New conclusions on the avoidance of danger from electromagnetic fields in the region of high-power radio transmitters .... See Entry 73628

Glass-ceramic-mediated, magnetic-field-induced localized hyperthermia: response of a murine mammary carcinoma .... See Entry 73629

A microcomputer-based multithermocouple system for use in microwave fields .... See Entry 73651

Therapeutic applications of electromagnetic heating .... See Entry 73653

Design of microwave hyperthermia applicators for optimum power transfer .... See Entry 73654

Optical fiber thermometer for medical use .... See Entry 73655

A temperature-sensitive respiratory alarm .... See Entry 73672

Preparation and transfer of ultrathin frozen-hydrated and freeze-dried cryosections for microanalysis in scanning transmission electron microscopy .... See Entry 73703

87.20 MEMBRANE BIOPHYSICS

73532 Nuclear magnetic relaxivity of chloroplast thylakoid membranes: response to saturating light flashes. R.R.Sharp, C.F.Yocum (Dept. of Chem., Univ. of Michigan, Ann Arbor, MI, USA).
Photobiochem. & Photobiophys. (Netherlands), vol.5, no.4, p.193-9 (April 1983).
Spinach chloroplast thylakoid membranes and oxygen-evolving PS II-enriched membranes were exposed to a series of saturating single-turnover flashes under conditions where water proton spin-lattice and spin-spin relaxation rates ($1/T_1 \equiv R_1$, $1/T_2 \equiv R_2$) were monitored. In membrane preparations devoid of contamination from manganese unrelated to the oxygen-evolving reaction, neither R_1 nor R_2 measurements showed significant flash-induced changes relative to values obtained for dark-adapted controls. When thylakoid membranes were supplemented with Mn^{2+}, flash-induced changes in R_1 could be obtained. These changes do not, however, show an oscillatory behaviour. It is concluded from these experiments that manganese functional in oxygen evolution is not monitored by NMR at 20-30 MHz in single-turnover flash experiments. (21 refs.)

73533 Incorporation of erythrocyte membranes into flat bilayer lipid membranes. I.N.Babunashvili, V.A.Nenashev (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.3, p.451-5 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.441-4 (1982).
Reports the voltage-current characteristics of flat bilayer lipid membranes modified with vesicles of rabbit erythrocyte membranes containing amphotericin *B* and tetraethylammonium. It is shown that in the course of a few minutes after contact of the vesicles and membrane there is partial fusion of the vesicles with the membrane for which in the region of contact a bilayer forms consisting of a monolayer of the lipids of the erythrocyte membrane and a monolayer of the flat membrane. After a few tens of minutes incorporation of the erythrocyte membranes into the flat membrane is observed either through fusion (uncoiling of the vesicles and their incorporation into the flat bilayer) or incorporation of the closed vesicle. Rise in temperature increases the probability of fusion as compared with incorporation. The closed vesicles are incorporated into the membrane asymmetrically: the area of contact is always less than the area of the non-contacting part. (8 refs.)

73534 Conductivity of model protein-lipid membranes. S.A.Badzhinyan, K.G.Manukyan (Inst. of Biochem., Acad. of Sci., Erevan, USSR).
Biophysics (GB), vol.27, no.3, p.461-5 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.450-3 (1982).
Artificial membranes of proteolipids (p.l.), purified to differing degrees, of bovine cerebral white matter distinguished by the content (72, 50-45 and 15-8 mass%) and the qualitative composition of the lipids bound to them have been

reconstructed. The conductivity of the artificial membranes of all three types of p.l. in 0.1 M solution of the chlorides of alkaline metals is higher by two to three orders than the bilayer membranes of lecithin and the total brain phospholipids, with the highest conductivity being shown in all cases by the p.l. membranes containing 85-92 per cent and the least by the p.l. containing 28 per cent of protein. The introduction of the liposomes from a mixture of p.l. and lecithin on one side of the bilayer lecithin membrane leads to gradual rise in its conductivity to a definite high level. The membranes of all three types of p.l. possess specific conductivity for monovalent cations which line up in the following order: $Na^+ > K^+ Cs > Li^+$. (11 refs.)

73535 Study of heat-induced structural rearrangements in the membranes and lipid of lyzosomes in experimental carcinogenesis. N.G.Kotrikadze, G.D.Gabuniya, O.S.Dzhishkariani, M.A.Tsartsidze, B.A.Lomsadze (Tbilisi State Univ., Tbilisi, USSR).
Biophysics (GB), vol.27, no.3, p.465-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.454-7 (1982).
Unlike lipid-water systems the structural transitions in lipids are studied in vesicles 'turned' to the outside on the hydrophobic side in an apolar and aprotonic solvent. The link between change in the structure and function of the lyzosome membranes is discussed. (8 refs.)

73536 Possible nature of the fluctuations of the reflective capacity of bilayer lipid membranes excited on electrostriction. V.I.Pasechnik (Phys. Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.481-7 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.469-74 (1982).
The nature of the fluctuations in the reflective capacity of bilayer lipid membranes (b.l.m.) for light of two different polarizations ($R_\parallel$, $R_\perp$) has been studied. The measurements of the capacitance of the b.l.m. showed that the cophasic fluctuations in $R_\parallel$ and $R_\perp$ appearing with a delay of several milliseconds relative to the moment of delivery to the b.l.m. of an electric field are not connected with the change in the thickness of the bilayer. These fluctuations are apparently due to capillary waves spreading from the tore to the centre of the b.l.m. and changing its curvature. The changes in the latter may be recorded by measuring the reflective capacity of the b.l.m. for a certain adjustment of the apparatus and are interpreted as apparent cophasic changes in $R_\parallel$ and $R_\perp$. (16 refs.)

73537 Theory of electrical breakdown of bilayer lipid membranes. Splitting of the energy barrier. V.F.Pastushenko, Yu.A.Chizmadzhev (Inst. of Electrochem., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.487-92 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.475-9 (1982).
The free energy of the membrane system is calculated as a function of the pore size. It is shown that allowance for the finite pore conductivity leads to increase in the height of the energy barrier and the calculated lifetime of the membrane in the field. It is shown that there exists a critical value of the parameter $s=\sigma\delta/\gamma$ (σ, γ are the coefficients of the surface and linear tensions, respectively; δ is the membrane thickness), below which in a certain intermediate region of tension the energy barrier is split. Sufficient for this effect is the practically always fulfilled condition of the smallness of the input resistance as compared with the pore resistance for a minimum size of the latter. The relation between the barrier heights depends on the parameter s and the tension, the height of the second barrier falling more rapidly than that of the first with rise in s and tension. (15 refs.)

73538 Use of refractometry for studying phasic transitions in flat lipid membranes. A.I.Khmel'nitskii, S.N.Cherenkevich (Belorussian State Univ., Minsk, Belorussian SSR).
Biophysics (GB), vol.27, no.3, p.570-2 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.550-2 (1982).
The phasic transition of films of lipids of varied origins were studied. To obtain the films the authors used the total lipid and phospholipid fractions, freshly isolated (chromatographically pure) and oxidized phosphatidylcholine of egg yolk and cholesterol recrystallized from acetone. (21 refs.)

73539 Single sodium channels from rat brain incorporated into planar lipid bilayer membranes. B.K.Krueger, J.F.Worley,III, R.J.French (Univ. of Maryland School of Medicine, Baltimore, MD, USA).
Nature (GB), vol.303, no.5913, p.172-5 (12 May 1983).
Presents the first report of electrical recordings from voltage-dependent sodium channels incorporated into planar lipid bilayers. In bilayers with many channels, batrachotoxin (BTX) induced a steady-state sodium current that was blocked by saxitoxin (STX) at nanomolar concentrations. All channels appeared in the bilayer with their STX blocking sites facing the side of vesicle addition, allowing the authors to define that as the extracellular side. Current fluctuations due to the opening and closing of single BTX-activated sodium channels were voltage-dependent (unit conductance, 30 pS in 0.5 M NaCl): the channels closed at large hyperpolarizing potentials. Slower fluctuations of the same amplitude, due to the blocking and unblocking of individual channels, were seen after addition of STX. Block of the sodium channels by STX was voltage-dependent, with hyperpolarizing potentials favouring block. The voltage-dependent gating, ionic selectivity and neutrotoxin sensitivity suggest that these are the channels that normally underlie the sodium conductance change during the nerve impulse. (27 refs.)

Headgroup interactions in mixed phospholipid bilayers ....See Entry 73512

Defect structures of the liotropic phases of phospholipids ....See Entry 73515

Transitions and molecular packing in highly purified 1,2-dipalmitoylphosphatidylcholine-water phases. I. Transitions, improved phase diagrams, method of packing analysis, molecular structures of diglyceride, and polar regions ....See Entry 73521

Dielectric studies of sonicated egg yolk lecithin at around 800 MHz ....See Entry 73529

Chlorophyll *a* in unilamellar vesicles made with chloroplast lipids. Absorbance and photobleaching ....See Entry 73540

Content of intracellular ATP and the structural state of proteins in the erythrocytic membrane ....See Entry 73542

Ion-exchange ratio and membrane potential in the bacteria S. faecalis ....See Entry 73548

Electrical simulation for the ionic conductances in the single nerve cell membrane ....See Entry 73551

Mechanism of the microwave effect on the conductivity of bilayer lipid membranes ....See Entry 73632

87.25 CELLULAR BIOPHYSICS

73540 Chlorophyll *a* in unilamellar vesicles made with chloroplast lipids. Absorbance and photobleaching. R.Carpentier (Centre de Recherche en Photobiophys., Univ. du Quebec, Trois-Rivieres, Quebec, Canada).
Photobiochem. & Photobiophys. (Netherlands), vol.5, no.4, p.245-52 (April 1983).
Vesicles were prepared with lipids extracted from chloroplast membranes including or not including chlorophyll *a*. Some aggregation of vesicles occurred at lipid concentrations higher than 1 $mg.ml^{-1}$. When the chlorophyll/lipid ratio was increased, an absorbance appeared at 700 nm. The photobleaching of chlorophyll was studied in those vesicles. When the chlorophyll/lipid ratio increased, the bleaching decreased (velocity as well as extent). It is suggested that energy dissipation occurs via chlorophyll aggregation and protects the chlorophyll from light. The photobleaching in the vesicles was compared with that in other systems containing chlorophyll *a* in order to evaluate the constituents responsible for chlorophyll photoprotection. (16 refs.)

73541 Light curves of photosynthesis on pulsed illumination. V.I.Zvalinskii, F.F.Litvin (Inst. of Marine Biology, Acad. of Sci., Vladivostock, USSR).
Biophysics (GB), vol.27, no.3, p.418-23 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.410-14 (1982).
A mathematical description of the light curve of photosynthesis on pulsed illumination is proposed for uni- and multicentral organization of the photosynthetic units. It is shown that the form of the curves is determined by the number of photosynthetic units in one domain (degree of multicentrality) and the efficiency of energy migration between them. A criterion for the experimental delimitation of these models is proposed. (8 refs.)

73542 Content of intracellular ATP and the structural state of proteins in the erythrocytic membrane. Ye.I.Slobozhanina, Ye.A.Chernitskii, N.M.Koslova (Inst. of Photobiology, Acad. of Sci., Minsk, Belorussian SSR).
Biophysics (GB), vol.27, no.3, p.434-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.425-9 (1982).
The effect of depletion and resynthesis of intracellular ATP on the functional properties of the erythrocytes (filtrability, osmotic stability) and the structural parameters of the membranes isolated from these erythrocytes (spectra of ultraviolet fluorescence, aggregation of proteins determined by gel-electrophoresis) has been studied. It is shown that when the erythrocytes are kept in a glucose-free medium at 37°C they and their membranes show a number of successive changes: crenation and fall in filtrability of the erythrocytes; change in the relative protein composition of the membranes, aggregation of the membrane proteins and shift of their fluorescence spectra to the shortwave side; loss of ability of the erythrocytes to return to the normal state on resynthesis of ATP in them accompanied by fall in the osmotic stability and increase in the filtrability of the cells. It is assumed that the shift of the fluorescence spectra of the membrane proteins is due to the processes of phosphorylation+dephosphorylation and to demonstrate them the paper presents data on the interaction of ATP with the membrane proteins in solution. (11 refs.)

73543 Electron paramagnetic resonance of phosphorylating and non-phosphorylating submitochondrial particles. O.S.Nedelina, Ye.S.Vishnevskii, O.N.Brzhevskaya, E.M.Sheksheyev, L.P.Kayushin (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.475-8 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.463-6 (1982).
The spin centres associated with the work of ATP synthetase and earlier detected in the mitochondria have been investigated in rat liver submitochondrial particles (s.m.p.) phosphorylating and not phosphorylating. It has been shown that a complex doublet signal with a half width $\sim 38\times10^{-4}$ T is recorded only on the actively phosphorylating and oligomycin-inhibited s.m.p. It has been established that the components of the signal are due to different spin centres, one of which ($g=2.03$) is apparently a metallo-centre, most probably non-haeme iron. The nature of the second doublet characterized by uniformly saturated components with $g=2.03$ and $g=2.00$ is not clear. Study of the saturation of the flavin signal with $g=2.00$ also showed that it consists of two components: one saturated characteristic of non-phosphorylating s.m.p. and the second non-saturated observed in the main in the phosphorylating s.m.p. and probably due to flavin forming part of ATP-synthetase. (8 refs.)

73544 Why is proton magnetic relaxation delayed in tumour cells?. Ye.I.Volkov (Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.578-9 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.557-9 (1982).
Recently growing interest has been aroused by the use of nuclear magnetic resonance for diagnosing malignant neoplasma. This method is based on the fact that the spin-lattice (T_1) and spin-spin (T_2) relaxation times of the protons of water molecules in malignant tumours are significantly longer than in the corresponding normal tissues. The main experimental facts are listed. The author proposes an interpretation of the n.m.r. experiments in the context of the solid 'carcass' liquid-mosaic models of the membrane developed earlier. (15 refs.)

73545 Settling of fixed erythrocyte suspension droplets. S.N.Omenyi, R.S.Snyder (Space Sci. Lab., Marshall Space Flight Center, Huntsville, AL, USA).
Biorheology (GB), vol.20, no.2, p.109-18 (1983).
The fractionation of micron-size particles according to physical properties of size, density and surface characteristics by centrifugation and electrophoresis is hindered when the particles behave collectively rather than individually. The formation and sedimentation of droplets containing particles is an extreme example of collective behavior and a major problem for these separation methods when large quantities of particles need to be fractionated. Experiments that measured droplet sizes and settling rates for a variety of particles and droplets are described. Expressions are developed relating the particle concentration in a drop to measurable quantities of the fluids and particles. The number of particles in each droplet was then estimated along with the effective droplet density and certain trends are noted. Since a major application of this work is the purification of biological cells in the range of 10 microns, for which monodisperse inert particles are not available, red blood cells from different animals fixed in glutaraldehyde provided model particle groups with the necessary size range, visibility and stability for these fluid dynamical studies. (16 refs.)

73546 The electrophoretic mobilities of minerals determined by laser Doppler velocimetry and their relationship with the biological effects of dust towards macrophages. R.Davies (MRC Pneumoconiosis Univ., Llandough Hospital, Penarth, Wales), A.W.Preece.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.129-40 (May 1983).
The role of surface charge in the pathogenicity of mineral dusts has been little studied, partly due to the time consuming nature of such determinations using conventional microelectrophoresis apparatus. In this work the use of

laser Doppler velocimetry proved to be a rapid method of determining the electrophoretic mobility of mineral dusts. Ceramic ball milling of fibrous minerals, whilst dramatically reducing the cytotoxicity of the dusts towards macrophages, had only a small effect on electrophoretic mobility. It is concluded that some other factor, possibly fibre morphology, is important for observed biological effects. The coating of quartz and kaolinite with poly-2-vinyl pyridine-N-oxide dramatically lowered their cytotoxicity towards macrophages. The dusts' electrophoretic mobilities were also lowered. The significance of these findings is discussed. (42 refs.)

73547 Mechanical fatigue as a possible determinant of in vivo longevity of red blood cells. C.K.N.Li, E.K.H.Li (Biological Labs., Harvard Univ., Cambridge, MA, USA).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.226-8 (April 1983).
Red blood cells lyse when subject repeatedly to osmotic swelling and shrinking. The number of osmotic cycles causing 50 percent of the cells to lyse increases exponentially as the magnitude of swelling decreases. An extrapolation of this relationship to the osmotic volume changes cells experience in vivo gives the survival half life of red cells in circulation. (11 refs.)

Determination of the real part of relative refractive-index of spherical particles using scattering-matrix components .... See Entry 71073

Nuclear magnetic relaxivity of chloroplast thylakoid membranes: response to saturating light flashes .... See Entry 73532

Incorporation of erythrocyte membranes into flat bilayer lipid membranes .... See Entry 73533

Coexistence of neurofilaments and vimentin in a neurone of adult mouse retina .... See Entry 73565

Cochlear effects of cryosurgery .... See Entry 73602

New conclusions on the avoidance of danger from electromagnetic fields in the region of high-power radio transmitters .... See Entry 73628

Cell surface effect of 60-Hz electromagnetic fields .... See Entry 73630

Effect of laser radiation on the synthesis of lipids in yeasts ... See Entry 73634

The oxygen enhancement ratio for single- and double-strand breaks induced by tritium incorporated in DNA of cultured human T1 cells. Impact of the transmutation effect .... See Entry 73637

X-irradiation effect on human red cells: hemoglobin study by Mossbauer spectrometry .... See Entry 73638

Dose-rate effects in mammalian cells. IV. Repairable and nonrepairable damage in noncycling C3H 10T$^{1}/_{2}$ cells .... See Entry 73640

Response of mouse small intestine to fractionated doses of pions .... See Entry 73642

Increased radioresistance of cells in cultured multicell spheroids. II. Kinetic and cytogenetic studies .... See Entry 73643

RBE of spleen CFU-S to low dose rate Cf-252 neutron or photon radiation .... See Entry 73644

Accumulation and lethal effect of tritium (tritiated water) in Rhodopseudomonas spheroides under light-anaerobic and dark-aerobic conditions .... See Entry 73645

Erythrocyte filtrability measurement by the initial flow rate method .... See Entry 73690

A light-scattering apparatus for the study of cellular suspensions .... See Entry 73695

The quantification and graphic display of correlations among three spike trains .... See Entry 73696

The identification of pollen grains using cathodoluminescence in the scanning electron microscope .... See Entry 73701

Preparation and transfer of ultrathin frozen-hydrated and freeze-dried cryosections for microanalysis in scanning transmission electron microscopy .... See Entry 73703

87.25D Biological transport; cellular and subcellular transmembrane physics

73548 Ion-exchange ratio and membrane potential in the bacteria S. faecalis. S.M.Martirosov, A.G.Bartanyan, L.S.Petrosyan (Erevan State Univ., Erevan, USSR).
Biophysics (GB), vol.27, no.3, p.479-81 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.467-8 (1982).
The authors have measured the energy-dependent membrane potential $\Delta\psi$ of S. faecalis equal to -140 mV and not changing with change in temperature from 37 to 18°C. In the period of generation of $\Delta\psi$ ion-exchange is observed in the ratio $2H^+$:lac:K^+ where the hydrogen and lactate ions leave the cells. Possibly in the membranes of S. faecalis an electrogenic proton potassium pump operates exchanging $2H^+$ for one K^+ ion of the medium. (5 refs.)

73549 Active transport of triphenylmethyl phosphonium in mitochondria. I.A.Skul'skii, V.V.Glazunov, S.M.Baklanova (Sechenov Inst. of Evolutionary Physiology & Biochem., Acad. of Sci., Leningrad, USSR).
Biophysics (GB), vol.27, no.3, p.492-7 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.480-4 (1982).
It is shown that the energy-dependent accumulation of triphenylmethylphosphonium ($TPMP^+$) in the mitochondria of the rat liver at 0°C is only 30-50 per cent less than at room temperature, but the rate of transport is so reduced as to make possible study of the kinetics of the process. The potassium diffusion potential speeds up the entry and slows the exit of $TPMP^+$ as to be expected for a penetrating cation in an electric field. On the other hand, energization of the mitochondria leading, as is thought, to rise in the membrane potential, hastens the entry of $TPMP^+$ but has no effect on the rate of its exit. These findings are not compatible with the presence of the metabolic membrane potential and indicate the active transport of $TPMP^+$ in mitochondria. Consequently the steady distribution of $TPMP^+$ cannot be used to determine the membrane potential. (12 refs.)

73550 Temperature characterization of oubaine-insensitive sodium flux in frog muscle. T.G.Ambartsumyan, G.G.Marikyan, S.Ya.Adamyan (Erevan Phys. Inst., Erevan, USSR).
Biophysics (GB), vol.27, no.3, p.502-6 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.489-92 (1982).
The authors have studied the anti-gradient efflux of Na^+ ions from Na^+ loaded frog skeletal muscle. It is shown that the oubaine-insensitive nondiffusional efflux of sodium at 22 and 2°C characterized by a low van t'Hoff temperature coefficient $Q_{10}=1.3$. A scheme is proposed according to which transfer of Na^+ ions from the cell into the external solution is carried out in two stages: enzymatic reaction at the inner boundary of the membrane and diffusional escape ions through the sodium channel of the membrane. It is shown that the energy expenditure of the cell going on the translocation of Na^+ through the inner boundary of the membrane into the channel ($\sim$13 kJ/mole) does not depend on temperature but the influence of temperature affects the second stage of ion transfer. (11 refs.)

73551 Electrical simulation for the ionic conductances in the single nerve cell membrane. Kyung-Joung Lee, Jae-Bong Ann, Myoung-Ho Lee.
Trans. Korean Inst. Electr. Eng., vol.31, no.12, p.187-97 (1982). In Korean.
Presents electrical characteristics of the single nerve cell membrane by using an electrical analog model based on the ionic conductances which is proposed by Hodgkin-Huxley. In modeling, the sodium conductance, g_{Na} and the potassium conductance, g_K, which specify the characteristics of the nerve cell membrane, are most important elements. In particular, since g_{Na} and g_K depend on the membrane voltage and the time, the dependences of g_{Na} and g_K both on the membrane voltage and the time was simulated by the FET having the properties that the drain-source conductance, g_{DS} of the FET is controlled by the gate voltage, V_G. Therefore, the dependence of the ionic conductance on the membrane voltage and the time was realized by feeding back the simulated membrane voltage to the gate terminal of the FET. (13 refs.)

Single sodium channels from rat brain incorporated into planar lipid bilayer membranes .... See Entry 73539

Peristaltic transport of a physiological fluid. I. Flow in non-uniform geometry .... See Entry 73614

Peristaltic transport of a physiological fluid. II. Flow in uniform geometry .... See Entry 73615

Peristaltic transport of a physiological fluid. III. Applications .... See Entry 73616

Mucociliary clearance in chronic sinusitis: related human nasal clearance and in vitro bullfrog palate clearance .... See Entry 73621

Non-thermal effect of UHF pulses of nanosecond duration on the transepithelial transfer of sodium ions .... See Entry 73633

87.30 BIOPHYSICS OF NEUROPHYSIOLOGICAL PROCESSES

(exc. perception processes and speech)

73552 The dielectric properties of normal and tumour mouse tissue between 50 MHz and 10 GHz. J.A.Rogers, R.J.Sheppard, E.H.Grant (Dept. of Phys., Queen Elizabeth Coll., London, England), N.M.Bleehen, D.J.Honess.
Br. J. Radiol. (GB), vol.56, no.665, p.335-8 (May 1983).
Microwaves are currently being investigated as a method of inducing hyperthermia. Values of the relative permittivity and conductivity of mouse muscle and tumour tissues over the frequency range 50 MHz to 10 GHz at a temperature of 37°C are reported. The data were obtained by using an on-line computer-based time-domain spectrometer. The tumour tissues were the RIF/1 and KHT fibrosarcomas sited in the hind leg muscle of C3H mice. A significant difference in the relative permittivity between the normal and tumour tissue was shown to exist at frequencies up to 200 MHz. (16 refs.)

73553 Study of the mechanism of the different behaviour of the period of helical excitation waves in the atrium and ventricle. A.K.Grenader, G.G.Zurabishvili (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.3, p.519-23 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.505-8 (1982).
On strips of the left atrium and wall of the right ventricle of the rabbit heart the sources of helical excitation waves—reverberators—were produced by delivering a single extra stimulus in the vulnerable phase of the action potential. It is shown that the period of the sources T increases in the first seconds after their appearance in atrial tissue and changes little after their appearance in ventricular tissue. The link between the changes in T and the refractoriness of heart tissue is investigated. A model is proposed explaining the different behaviour of T in the atrium and ventricle. (9 refs.)

73554 Stochastic fluctuations in a dynamic system modelling macroscopic activity of nerve tissues. V.I.Sbitnev (Leningrad Konstantinov Inst. of Nuclear Phys., Acad. of Sci., Leningrad, USSR).
Biophysics (GB), vol.27, no.3, p.530-5 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.515-19 (1982).
Stochastic fluctuations may display dynamic systems with a quite simple structure and in which sources of uncontrollable noise are absent. Such fluctuations are shown by the system $Z_{k+1}=(1+\exp(V-HZ_k)^{+1})\ (\mathrm{mod}\ I)$ which differs from the Amari system proposed to describe the macroscopic activity of neuronal nets by adding the term mod I with $I<1$. It has been established that the sequence $Z_1, Z_2 \ldots Z_k, \ldots,$ corresponds to the fluctuations in the postsynaptic potential on the exciting neurons and the operation mod I is due to the regulatory functions of the inhibitory neurones. (19 refs.)

73555 Change in the constant electric field of man during adaptation to conditions of hypokinesia. G.N.Zatsepina, S.P.Kuprin, S.V.Tul'skii, M.N.Flerov (Phys. Faculty, Lomonosov State Univ., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.536-42 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.520-6 (1982).
The kinetics of change in the constant electric field of man in the course of adaptation to hypokinesia from a normal physical load and vice versa has been studied. It is shown that adaptation—transitional regime from one physiological state to another—shows uniform values of the electrical potential difference (e.p.d.) between fixed points of the human skin. If the body is already in the state of adaptation the superposing of one adaptation process on another does not change the mean values of the e.p.d. of the level of adaptation. The level of adaptation constitutes the upper value for the amplitude of the e.p.d. of the healthy body. (10 refs.)

73556 The physiological (EEG) nature of drowsiness and its relation to performance deficits in narcoleptics. V.Valley, R.Broughton (Dept. of Psychology, Univ. Hospital, London, Ontario, Canada).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.243-51 (March 1983).
Ten narcoleptics off medication were compared to matched controls to determine the pattern and level of electroencephalographic (EEG) vigilance, and its relation to performance ability on the 1 h Wilkinson auditory vigilance task. The narcoleptics performed significantly more poorly and spent significantly less time in wakefulness than controls. The EEG of the patients revealed continual fluctuations between wakefulness, stage 1A (slowed and diffusing alpha) and stage 1B (theta activity). Stage 2 sleep only occurred briefly in 4 patients. Stages 3, 4 and REM sleep were never encountered. Controls were continually awake aside from very brief appearances of stage 1A in 5 subjects. Narcoleptic performance during stages 1B and 2 was characterized by lapses (response omissions). Patients also demonstrated significantly more lapses as well as false positive responses than controls during wakefulness and stage 1A. Poorer performance even during wakefulness was demonstrated to be related to inability to sustain wakefulness over time. The results clarify the temporal pattern of physiological vigilance during perfor-

mance in narcoleptics and also demonstrate the insufficiency of the lapse-microsleep formulation in explaining performance deterioration in these patients. (35 refs.)

73557 The direction of spread of alpha activity over the scalp. T.Inouye, K.Shinosaki, A.Yagasaki (Dept. of Neuropsychiatry, Osaka Univ. Medical School, Osaka, Japan).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.290-300 (March 1983).
The direction of spread of alpha activity over the scalp was studied using the modified 'entropy analysis' method which distinguishes the direction of time differences between two correlated signals in the alpha band. The resting EEG was recorded from F3, F4, C3, C4, P3, P4, O1 and O2, each referenced to linked ears in 10 subjects. The directed measure of correlation of alpha activity in two directions (e.g., from O1 and O2 and from O2 to O1) was obtained from all possible pairs of electrodes. The dominant longitudinal direction of alpha activity was found to be anterior to posterior within as well as across hemispheres. No dominant transverse direction was found. This suggests that the spread of alpha activity over the scalp is in the dominant anterior-posterior direction. (23 refs.)

73558 Two types of interictal transients of reversed polarity in rat hippocampus during kindling. W.J.Wadman, F.H.Lopes Da Silva (Dept. of Animal Physiology, Univ. of Amsterdam, Amsterdam, Netherlands), L.-W.S.Leung.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.314-19 (March 1983).
Two different types of spontaneous interictal transients (SITs) have been found in the course of the development of an epileptogenic focus by Schaffer collateral kindling in the CA1 region of rat hippocampus. The first type has peak amplitudes of 250 μV up to 1 mV, a duration of about 80 msec and the same polarity as field potentials recorded from the same sites evoked by Schaffer collateral stimulation. These SITs occur early during kindling, but are also observed at later stages. The second type, which is dominant in later stages of kindling, has peak amplitudes of 2-3 mV, a duration of about 20 msec and the opposite polarity; in a later stage it may also contain a clear population spike. Both types can be considered as being caused by equivalent dipoles situated across the pyramidal cell layer of CA1 but with inverted polarities. (22 refs.)

73559 On the possibility to determine integral characteristics of the cardiac electric generator from extracardiac electric and magnetic measurements. L.I.Titomir (Inst. of Problems of Information Transmission, Acad. of Sci., Moscow, USSR), P.Kneppo.
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.222-6 (April 1983).
The relation between the electric and magnetic fields of the heart outside the body is considered on the assumption that the primary bioelectric generators impressed membrane currents may be represented as geometrically curvilinear thread-like flows. An approach based substantially upon the multipole expansion of scalar potentials is developed for distinguishing between two parts of a measured total magnetic field, the first part being uniquely joint with the electric field, and the second being independent and containing information about curvilinearity of the elementary generators. (16 refs.)

73560 Sudden cardiac death: a problem in topology. A.T.Winfree.
Sci. Am. (USA), vol.248, no.5, p.118-31 (May 1983).
Many sudden deaths are the result of fibrillation: a disruption of the coordinated contraction of heart muscle fibers. The cause may lie in a state of affairs described by a mathematical theorem. (no refs.)

Possible nature of the fluctuations of the reflective capacity of bilayer lipid membranes excited on electrostriction ....See Entry 73536

Theory of electrical breakdown of bilayer lipid membranes. Splitting of the energy barrier ....See Entry 73537

Ion-exchange ratio and membrane potential in the bacteria S. faecalis ....See Entry 73548

Electrical simulation for the ionic conductances in the single nerve cell membrane ....See Entry 73551

Electromechanical and physicochemical properties of connective tissue ....See Entry 73624

New conclusions on the avoidance of danger from electromagnetic fields in the region of high-power radio transmitters ....See Entry 73628

Effect of EMG onset variation on average motor potentials ....See Entry 73673

Automatic classification of electromyographic signals ....See Entry 73674

Evaluation of ECG recorders ....See Entry 73679

A simple noise clipping circuit for neurophysiological audio monitors ....See Entry 73693

A low-noise low input impedance amplifier for magnetic measurements of nerve action currents ....See Entry 73694

The quantification and graphic display of correlations among three spike trains ....See Entry 73696

A method for combining field potential recording with local perfusion in the hippocampus of the anaesthetized rat ....See Entry 73700

87.32 PHYSIOLOGICAL OPTICS, VISION

87.32C Anatomy and optics of the eye

73561 Visual accommodation in the flying fox (Pteropus giganteus). C.J.Murphy (Dept. of Veterinary Anatomy, Cornell Univ., Ithaca, NY, USA), H.C.Howland, G.G.Kwiecinski, T.Kern, F.Kallen.
Vision Res. (GB), vol.23, no.6, p.617-20 (1983).
The flying fox, Pteropus giganteus, possesses a papillated retina and was previously thought to lack a mechanism for active accommodation. An investigation of the anatomy and physiology of accommodation in this megachiropteran bat revealed that it has a well developed ciliary muscle and that it can actively accommodate through a range of at least 3.12 D. In addition, it was found that the origin of the retinoscopic reflex does not reside in the receptor layer of the retina, because the focus of the eye is invariant for small changes of angle of refraction. (11 refs.)

87.32E Physiology of the eye; nerve structure and function

73562 An X-ray study of bleached and unbleached frog retinal photoreceptors as a function of elapsed time. C.R.Worthington, A.R.Czeto (Dept. of Biological Sci. & Phys., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Photobiochem. & Photobiophys. (Netherlands), vol.5, no.4, p.229-36 (April 1983).
A series of low-angle X-ray diffraction patterns has been recorded from bleached and unbleached frog retinal photoreceptors by using successive X-ray exposures. The disc-to-disc repeat distances show increases with elapsed time. These increases derive from unequal increases in the intra- and interdisc fluid spaces with the disc membrane remaining relatively unchanged in structure. There is a small but definite difference between the electron density profiles of the bleached and unbleached photoreceptors. This difference in profiles is due to an increase of electron density at the membrane surface facing the intradisc space on bleaching. (11 refs.)

73563 Visual and auditory anomalies in Chediak-Higashi syndrome. D.Creel (Dept. of Ophthalmology, Univ. of Utah, Salt Lake City, UT, USA), L.A.Boxer, A.S.Fauci.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.252-7 (March 1983).
Albinism is correlated with misrouting of decussating retinal fibers in the brain. There is also evidence of anomalies of decussating auditory pathways in albinos. The Chediak-Higashi syndrome (CHS) is a rare form of partial albinism which includes increased susceptibility to infections, a hemorrhagic tendency and peripheral polyneuropathies. Binocular and monocular pattern-onset visually evoked potentials (VEPs) and monaural auditory brain stem responses (ABRs) were recorded from 4 subjects with CHS. Three of the CHS demonstrated asymmetric monocular VEPs and failed the Titmus stereovision test. All 4 CHS produced asymmetric ABRs similar to those reported for albinos. Although the hair, skin and irises are relatively well pigmented in CHS, these individuals apparently have anomalies of their central visual and auditory pathways. (32 refs.)

73564 Neural mechanisms of pattern vision in the monkey. I. Preface. E.Iwai (Tokyo Metropolitan Inst. for Neurosci., Fuchi, Japan).
J. Inst. Electron. & Commun. Eng. Jpn. (Japan), vol.66, no.1, p.44-6 (Jan. 1983). In Japanese.
Pattern recognition or identification consists in processing information about the pattern through the process of learning; consequently, it can be referred to as a high-level thought process. When a person makes a decision process for visual information, a signal is sent out through his sense system and recognition system, and recognition behaviour is revealed. Such physiological knowledge can be applied to pattern recognition processes in information engineering. (3 refs.) *K.B.*

73565 Coexistence of neurofilaments and vimentin in a neurone of adult mouse retina. U.C.Drager (Dept. of Neurobiology, Harvard Medical Scool, Boston, MA, USA).
Nature (GB), vol.303, no.5913, p.169-72 (12 May 1983).
Different clases of intermediate filaments are restricted to particular cell types. However, evidence is presented here of an exception to that rule in the outer plexiform layer of the mouse retina. Double-labelling with antibodies to neurofilaments and vimentin showed that both types of intermediate filaments coexisted in the axonless horizontal cell of that retinal layer, recalling the previous notion that these cells are glial or intermediate between neuronal and glial (H. Wassle et al., 1978). (19 refs.)

73566 Protons block the dark current of isolated retinal rods. P.Mueller, E.N.Pugh,Jr. (Univ. of Pennsylvania, Philadelphia, PA, USA).
Proc. Natl. Acad. Sci. USA, vol.80, no.7, p.1892-6 (April 1983).
Membrane currents of isolated frog rods were recorded with the suction pipette technique and tested by perfusion techniques for their sensitivity to H^+. The following facts have been established. (*i*) Increased $[H^+]$ suppresses the Na^+ conductance of the outer segment rapidly and reversibly. (*ii*) H^+ acts in the rod interior. (*iii*) The $[H^+]$ necessary to cause a 50% decrement in Na^+ conductance is inversely related to the $[Ca^{2+}]$ over 5 orders of magnitude. (*iv*) The sensitivity to H^+ and the sensitivity to light, as a function of $[Ca^{2+}]$, have the same slope. Thus, H^+ act like light in effecting membrane current suppression but behave as if their effect is mediated through Ca^{2+}. Based on these results and properties of rod disk membrane phosphodiestrase, the authors propose that protons produced in the light-activated hydrolysis of cGMP liberate Ca^{2+} from the disks by ion exchange. (43 refs.)

73567 The neurobiology of image. M.Imbert (Univ. of Paris Sud, Orsay, France).
Recherche (France), vol.14, no.144, p.600-4, 607-13 (May 1983). In French.
Between a light ray hitting the retina at the base of the eye and an image forming 'in the brain' several milliseconds elapse. During this time the light information received undergoes successive treatments. Work in neurophysiology during the last 20 years has started to lift the veil on the working of nerve cells and the retina. The paper deals with the subject generally and it is generously provided with diagrams. The action of the retina is described as a mosaic of receivers. Some experiments carried out on the subject are described and the filter role of the retina is explained. The compression of information by the retina is described, as are the distribution of fibre optics in the brain. Primary vision is explained, as are the sensitivity to contrasts and kindred types of functioning. (31 refs.) *G.V.D.*

73568 Nerve fiber layer of the primate retina: thickness and glial content. T.E.Ogden (Dept. of Physiology, Univ. of Southern California, School of Medicine, Los Angeles, CA, USA).
Vision Res. (GB), vol.23, no.6, p.581-7 (1983).
A topographic map of nerve fibre layer thickness was prepared from serial sections of the retina of the cynomolgus monkey. Montage electron micrographs of the nerve fiber layer were used to determine the relative proportions of axons and of glial processes within a given nerve fiber bundle at various positions across the retina. The cross-sectional area of nerve fiber bundles occupied by glia was never less than 18%, and in most cases was 20-30%. The proportion of glia in the bundles varied from point to point across the retina without respect to nerve fiber layer thickness and at some locations was as much as 42%. (16 refs.)

73569 Pupillary escape intensified by large pupillary size. F.Sun, L.Stark (Dept. of Physiological Optics & Engng. Sci., Univ. of California, Berkeley, CA, USA).
Vision Res. (GB), vol.23, no.6, p.611-15 (1983).
Pupil responses to light are greatly influenced by initial pupil size. Small pupils, operating under photopic conditions, show tonic responses to step increases of light and high gains; thus the pupil is a good regulator of light. Large pupils, operating under mesopic or scotopic conditions show phasic responses, 'pupillary escape', and smaller gains; the pupil only transiently

influences retinal flux. By using accommodation level to set the size of the pupil, the mechanism of the 'pupil size effect' is shown to be dependent on retinal light level only so far as retinal activity sets pupil size. (23 refs.)

73570 The impulse response of a movement-detecting neuron and its interpretation. M.V.Srinivasan (Dept. of Neurobiology, Australian Nat. Univ., Canberra, Australia).
Vision Res. (GB), vol.23, no.6, p.659-63 (1983).
When a visual pattern undergoes a brief displacement, the response of the neuron depends primarily upon the size of the displacement. One measures a tradeoff between velocity and duration of motion, analogous to the reciprocal relationship between intensity and duration in the perception of a brief flash of light (Bloch's law). Characterizing the movement detector by its 'impulse response' could be useful in predicting the response to arbitrary motions. (19 refs.)

Visual accommodation in the flying fox (Pteropus giganteus) ..See Entry 73561

Visual evoked potentials to light flash in cats: is a frontal sinus reference electrode truly indifferent? ....See Entry 73692

87.32L Light detection; adaptation and discrimination

73571 Light and the work environment. H.D.Range (AEG-Telefunken, Springe, Germany).
Elektr. Energ.-Tech. (Germany), vol.28, no.2, p.25-8 (April 1983). In German.
The effect of intensity of illumination of humans with regard to productivity, fatigue, production faults and accidents is considered. The significance, scope and contents of the German Standard DIN 5035 'Interior lighting with artificial light' are outlined, the influence on the work environment is discussed and reference is made to the interrelation with regulations and guidelines. (21 refs.) *P.G.R.*

73572 The development of light adaptation in human infants. J.L.Dannemiller, M.S.Banks (Dept. of Psychology, Univ. of Texas, Austin, TX, USA).
Vision Res. (GB), vol.23, no.6, p.599-609 (1983).
Increment threshold functions were measured from -4.0 to 1.2 log cd/m^2 in 7-12-week-old infants using a behavioral forced-choice paradigm. The slopes of the infant functions were considerably shallower than the slopes of adult functions over the same luminance range. The value of the infant slope increased rapidly between 7 to 12 weeks postnatally. A number of explanations for this developmental shift are considered. It is concluded that changes with age in either spatial summation or intensity-response function gain could cause the increase in slope. (40 refs.)

Evidence for conformational substates of rhodopsin from kinetics of light-induced charge displacement ....See Entry 73514

Bathorhodopsin intermediates from 11-cis-rhodopsin and 9-cis-rhodopsin ....
....See Entry 73531

Protons block the dark current of isolated retinal rods ....See Entry 73566

87.32N Colour detection; adaptation and discrimination

73573 Spatial sensitization and desensitization with small adapting fields: interactions of signals from different classes of cones. C.F.Stromeyer (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA).
Vision Res. (GB), vol.23, no.6, p.621-30 (1983).
Thresholds for brief, tiny flashes were measured on small adapting fields at 5° retinal eccentricity. Rod influence was eliminated by bleaching. Green and red small adapting fields raised the threshold for a green test flash by stimulating both middle and long wave cones—thus spatial desensitization by small adapting fields is not cone-specific. However, a small adapting field that strongly stimulated only short wave cones did not affect the visibility of a long wave flash. Spatial sensitization was also measured, using green or red annuli that surrounded a small red field and green test probe. Sensitization was not cone-specific. Possible mechanisms producing desensitization with small fields and annular sensitization are discussed. (45 refs.)

73574 Distinguishing opponent and non-opponent detection pathways in early dark adaptation. A.Reeves (Inst. fuer Arbeitsphysiologie, Univ. Dortmund, Dortmund, Germany).
Vision Res. (GB), vol.23, no.6, p.647-54 (1983).
Desensitization of the red-green opponent pathway was demonstrated in early dark adaptation with the aid of a test chosen to isolate that pathway. Isolation was achieved by requiring the observer to adjust the intensity of a foveal test light to the threshold for flicker, when the test alternated slowly between luminance-matched red and yellow fields. The luminance matches were precise enough that only an opponent pathway could mediate the flicker thresholds. Desensitization occurred after continuous light adaptation to 626 nm fields, but did not occur after adaptation to yellow fields, or if the 626 nm field was turned on and off at 2 Hz throughout adaptation. The properties of the red-green pathway measured with the flicker thresholds resemble those of the yellow-blue pathway as shown in transient tritanopia. (16 refs.)

The possible elemental nature of brown ....See Entry 73577

87.32S Psychophysics of vision, visual perception, binocular vision

73575 Vertical fusional response to asymmetric disparities. A.E.Kertesz, A.L.Perlmutter (Biomedical Engng. Center, Northwestern Univ., Evanston, IL, USA).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.246-50 (April 1983).
Objective measurement of the human vertical fusional response to asymmetric disparity presentation was carried out. Ramp disparities evoked mostly monocular eye movements. Step disparities evoked binocular eye movements which began with conjugate saccades followed by slower vergence movements. The two saccade amplitudes were approximately equal, and each was greater than half of the disparity. Motor compensation was mostly incomplete, allowing for the existence of a significant sensory component. Slower time course characterized the vertical vergence movements which were otherwise similar to the horizontal motor response to asymmetric disparity presentation. (13 refs.)

73576 Shifts in perceived size due to masking. D.J.Gelb, H.R.Wilson (Dept. of Biophys. & Theoretical Biology, Univ. of Chicago, Chicago, IL, USA).
Vision Res. (GB), vol.23, no.6, p.589-97 (1983).
It has been suggested that perceived size depends upon the distribution of responses among a localized population of different size-tuned mechanisms. If so, then spatial frequency masking, which alters the distribution of response, should produce shifts in a test pattern's perceived size. The authors have found this to be the case. The magnitude and direction of the shifts depend only on the frequency difference in octaves ($\Delta\omega$) between mask and standard. The results are not antisymmetric about the point $\Delta\omega=0$, however, as they would be if perceived size were based purely on local size-tuning properties. The authors' results suggest that size perception depends both on these local properties and on the spatial distribution of mechanism responses. (27 refs.)

73577 The possible elemental nature of brown. K.Fuld, J.S.Werner, B.R.Wooten (Neurologische Universitatsklinik mit Abteilung fur Neurophysiologie, Freiburg, Germany).
Vision Res. (GB), vol.23, no.6, p.631-7 (1983).
The continuous judgmental color-naming technique was used to assess the elemental nature of names descriptive of dark colors. Subjects were instructed to describe the color of a 0.54 deg, 2.5 log td test field of either 450, 530, 580 or 660 nm, that was surrounded by an achromatic annulus of 3.8 deg outer diameter. The annulus was varied in retinal illuminance from 1.5 to 3.7 log td. Test field and annulus were flashed simultaneously for 1 sec to the fovea of one eye. Results from 3 subjects indicated that the names blue, green, red and black were necessary and sufficient for describing the 450, 530 and 660 nm test fields. The 580 nm test field required the color name brown, in addition to the names yellow and black, to describe it when intermediate surround intensities were used. Additional results suggested the possible elemental nature of the color name brown. (21 refs.)

73578 Displacement limits, directional anisotropy and direction versus form discrimination in random-dot cinematograms. J.J.Chang, B.Julesz (Bell Labs., Murray Hill, NJ, USA).
Vision Res. (GB), vol.23, no.6, p.639-46 (1983).
Apparent motion mediated by the short-range process was studied. Random-dot cinematograms were used to determine the maximum displacement (d_{max}) for motion-direction and pattern discrimination. d_{max} is the maximum spatial separation between a correlated region (target) in the two successively presented random-dot images, when observers can correctly identify the direction of motion or the shape of the target. The authors have found that: (1) d_{max} for motion-direction discrimination increases with the square root of the display area; (2) d_{max} is invariant with eccentricities of 4 deg arc; (3) For rectangular targets and brief presentations, d_{max} increases with increases of that target-dimension which is parallel to the orientation of the movement. These findings indicate that short-range movement perception is an orientation specific global process. Furthermore, motion-direction discrimination and pattern discrimination of random-dot cinematograms may be mediated by different levels of processes. However, even for pattern discrimination d_{max} in visual angle increases with increased target area. (12 refs.)

73579 An oblique effect of spatial summation. P.C.Quinn, S.Lehmkuhle (Dept. of Psychology, Brown Univ., Providence, RI, USA).
Vision Res. (GB), vol.23, no.6, p.655-8 (1983).
Contrast thresholds for sinewave gratings were measured as a function of the number of cycles in the grating for two different orientations and three spatial frequencies. At high spatial frequencies, where an oblique effect of contrast sensitivity was demonstrated, there was a greater increase in contrast sensitivity as a function of the number of cycles for the vertical gratings than for oblique gratings. At a lower spatial frequency, where the contrast sensitivity anisotropy was greatly diminished, both orientations displayed a similar increase in contrast sensitivity when the number of cycles in the grating was increased. (23 refs.)

73580 The induced effect: a reply to the arguments of Mayhew and Frisby. A.Arditi (Dept. of Psychology, New York Univ., New York, NY, USA), L.Kaufman, J.A.Movshon.
Vision Res. (GB), vol.23, no.6, p.665-8 (1983).
In ibid., vol.22, p.1225-8, (1982) Mayhew and Frisby raised a number of questions concerning the authors' recently presented theory of the induced size effect (see Arditi et al., ibid. vol.21, p.755-64, 1981). The authors feel that Mayhew and Frisby have correctly pointed out some errors in the authors' original exposition of their theory. The authors feel however that Mayhew and Frisby are incorrect when they say that their objections are insuperable. (5 refs.)

The impulse response of a movement-detecting neuron and its interpretation ....
....See Entry 73570

87.34 AUDITION

73581 Perceptibility of pitch changes in a tonal signal emitted by a moving source. U.Jorasz (Dept. of Acoustics, Adam Mickiewicz Univ., Poznan, Poland).
Arch. Acoust. (Poland), vol.7, no.1, p.3-11 (1982).
The starting point for the experimental research was a psychoacoustic analysis of the Doppler effect. The investigations were performed under laboratory conditions using an electronic model of a moving source. Data were obtained on the relationship between the sensations of pitch and loudness of a tonal signal under dynamic conditions. (5 refs.)

73582 Middle-latency auditory evoked responses during open-heart surgery with hypothermia. P.Kileny, D.Dobson, E.T.Gelfand (Univ. of Alberta Hospital, Edmonton, Alberta, Canada).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.268-76 (March 1983).
Middle-latency auditory evoked responses (MLRs) were recorded from infants and adults before and during open heart surgery. Hypothermia was induced through perfusion cooling by cardiopulmonary bypass. In infants deep hypothermia (to 15°C nasopharyngeal temp.) was often followed by the induction of total circulatory arrest. In adults nasopharyngeal temperatures of 25°C were reached. The MLRs were elicited by unfiltered clicks presented through an insert type earphone and recorded with a vertex to ipsilateral earlobe electrode configuration. The MLRs proved to be resistant to muscle relaxation induced by pancuronium and to anesthesia induced and maintained in most cases by fentanyl. In most cases MLR peak latencies were progressively delayed as temperature decreased. Hypotension resulted in decreased MLR (Pa) amplitude. (29 refs.)

73583 Exponential electrophysiological aging: P3 latency. W.S.Brown (Dept. of Psychiatry & Biobehavioral Sci., Univ. of California School of Medicine, Los Angeles, CA, USA), J.T.Marsh, A.LaRue.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.277-85 (March 1983).
Forty-nine normal volunteer subjects ranging in age from 15 to 80 years were studied in an 'auditory oddball' event-related potential paradigm. In certain respects the authors' results replicate other studies, finding significant correlations between age and both N2 and P3 latency. Slopes of the linear age/ERP latency regression function increased with component number (i.e., N1<P2<N2<P3). Further analysis disclosed that the age/ERP component latency relationship is non-linear. Separate age/ERP component latency linear regression functions were computed for subjects 15-45 and 46-80. None of these functions were significant for subjects under 45. Age/latency slopes

were significant in the older group for P2, N2 and P3. The age/P3 latency slope for the subjects under 45 was 0.53 msec/year, versus 3.14 msec/year for the subjects over 45. The data for P3 latency and age are best fitted with a curvilinear first and second degree orthogonal polynomial, which describes a positively accelerating latency increase with age. Clinical implications of the form of the age/P3 latency regression function (curvilinear vs. linear) are discussed. (26 refs.)

73584 **Brain stem auditory evoked potentials: reduction of evaluation errors.** K.Ya.Ogleznev, A.A.Zaretsky, S.A.Shesterikov (Dept. of Neurosurgery, Central Inst. of Advanced Medical Studying, Moscow, USSR).

Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.331-2 (March 1983).

The commonly used method of brain stem auditory evoked response evaluation is measuring the latency to the extreme points of the components. Because of the influence of noise it is sometimes impossible to determine precisely the true top of the peak. It is possible to avoid this defect by estimating the latency to the middle of the peak front. In this research for both methods of evaluation were calculated for all interpeak intervals. According to the obtained data the use of the middle of the front of the peak for the latency evaluation gave a 24% reduction in the standard deviations. (no refs.)

73585 **Frequency-domain investigations of cochlear stability in the presence of active elements.** S.Koshigoe, A.Tubis (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).

J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1244-8 (April 1983).

For a linear, time-invariant cochlear response function, the requirements of causality and stability imply the absence of poles of the spectral response function $g(\omega)$ for $\mathrm{Im}\ \omega>0$, with $e^{-i\omega t}$ as the time-dependence factor. The existence of such poles invalidate conventional Hilbert transform (dispersion) relations. The testing of these dispersion relations provides a frequency-domain check of system stability for cochlear models which contain active elements such as negative resistance. The stability of several one- and two-dimensional cochlear models with active elements is checked using these dispersion relations. A simple circuit analog of the cochlea, which contains active elements, is used to illustrate the relationship between the pole locations of $g(\omega)$ and the strength of active elements. (30 refs.)

73586 **Further studies of auditory profile analysis.** D.M.Green, G.Kidd,Jr. (Lab. of Psychophys., Harvard Univ., Cambridge, MA, USA).

J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1260-5 (April 1983).

The discrimination of a change in the intensity of a component or components of a multitone complex is reported as a function of a number of experimental variables. In one experiment, changes in the shape of the spectrum were explored to determine which kinds of changes are more easily detected. Although different signal spectra produced different thresholds, the change in a single component produced the lowest threshold on an energy basis. Various binaural conditions were tested to determine if the shape or profile of the stimulus could be supplied by the ear opposite the one in which the signal was presented. Conditions where spectral contrasts were available to both ears simultaneously (diotic conditions) were much more sensitive than conditions where the spectral contrasts occurred for opposite ears (dichotic conditions). Finally, the level of the component at the signal frequency was varied relative to the other, equal amplitude, components to form a 'pedestal' upon which the signal was added. Detection of the signal was roughly the same for pedestal levels within about ±12 dB of the background except for conditions where masking was apparent. (10 refs.)

73587 **A central spectrum model: a synthesis of auditory-nerve timing and place cues in monaural communication of frequency spectrum.** P.Srulovicz (Dept. of Biomedical Engng., Johns Hopkins Univ. School of Medicine, Baltimore, MD, USA), J.L.Goldstein.

J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1266-73 (April 1983).

A probabilistic psychophysical model for monaural communication from the auditory nerve to the brain is given in the form of a tonotopic display of stimulus spectrum, termed central spectrum. The model builds upon prior research demonstrating the potential of neural timing cues from the auditory nerve for conveying information on complex spectra, and was designed to meet the quantified demands of the psychophysics of frequency measurement. The central spectrum magnitude at each frequency is determined by the response of the auditory-nerve fiber with characteristic frequency matching that frequency. An interval histogram from each fiber is passed through a filter matched to the characteristic frequency of the fiber. This output versus characteristic frequency defines the central spectrum. Detailed analysis demonstrates that efficient probabilistic processing of the central spectrum describes known psychophysical properties of frequency measurement in discrimination and periodicity pitch experiments. Psychophysical models based upon the central spectrum model followed by optimum probabilistic pattern recognition are potentially relevant for predicting human communication limits in response to arbitrary sounds of speech and music. (42 refs.)

73588 **The ear effect as a function of age and hearing loss.** D.Y.Chung, K.Mason, R.P.Gannon, G.N.Wilson (Workers' Compensation Board of British Columbia, Richmond, British Columbia, Canada).

J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1277-82 (April 1983).

Many studies have shown that the right ear statistically is slightly more sensitive than the left ear, particularly in the male adult population. In this study, the authors examined the lateral difference in hearing sensitivity, termed the ear effect here, in an industrial noise-exposed, nonshooting population, by sex, age, and hearing level. It was found that the male population had a larger ear effect (right ear being more sensitive) than the female population. The magnitude of the ear effect was found to be significantly related to the hearing threshold level. The ear effect was highest when the threshold was between 30- and 40-dB HL. Several possible causes for the ear effect are discussed. (11 refs.)

73589 **Intensity discrimination with cochlear implants.** B.E.Pfingst, P.A.Burnett, D.Sutton (Dept. of Otolaryngology & Regional Primate Res. Center, Univ. of Washington, Seattle, WA, USA).

J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1283-92 (April 1983).

Intensity difference limens were measured for various frequencies and intensities of sinusoidal and pulsatile electrical stimulation in monkeys with electrodes implanted in the scala tympani, scala vestibuli, modiolus, or middle ear. Difference limens decreased, as a function of initial stimulus intensity, from values of 1.5-3 dB near threshold to as low as 0.5 dB near the upper limit of the dynamic range. If sensation level was held constant, difference limens decreased as a function of frequency up to about 500 Hz, and then remained constant. They were similar across a variety of electrode placements and separations if differences in threshold and dynamic range were taken into account. However, difference limens measured in severely damaged ears were slightly smaller than those in moderately damaged ears. The near miss to Weber's law, characteristic of acoustic difference limens, was not seen with electrical stimuli. Difference limens for electrical stimuli were roughly one-half those for acoustic stimuli; thus, part of the deficit in dynamic range for electrical stimulation compared with acoustic stimulation is countered by the smaller intensity difference limens for electrical stimuli. (33 refs.)

73590 **On the undamped natural frequencies and mode shapes of a finite-element model of the cat eardrum.** W.Robert, J.Funnell (Dept. of Otolaryngology, McGill Univ., Montreal, Quebec, Canada).

J. Acoust. Soc. Am. (USA), vol.73, no.5, p.16578-61 (May 1983).

This paper presents a three-dimensional finite-element model of the cat eardrum which includes inertial effects. The model is implemented using a hierarchical modeling scheme which permits the mesh resolution to be varied. The static behavior of the model is calculated as a function of mesh resolution in order to check the validity of an earlier model. The first six undamped natural frequencies, and the corresponding modal vibration patterns, are then calculated. They are found to lie between about 1.8 and 3.2 kHz for the standard values chosen for the model parameters. The effects on the natural frequencies of varying seven parameters of the model are described. (8 refs.)

73591 **The temperature dependency of neural and hair cell responses evoked by high frequencies.** M.C.Brown, D.I.Smith, A.L.Nuttall (Kresge Hearing Res. Inst., Univ. of Michigan Medical School, Ann Arbor, MI, USA).

J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1662-9 (May 1983).

A fine thermocouple, placed on the round window of the guinea pig cochlea, was used to measure temperature and electrical potentials. In acute experiments, rectal temperature was held constant at 38°C while cochlear temperature was varied between 38°C and 31.5°C. Cochlear cooling to 36°C caused elevated thresholds for the compound action potential (CAP) in response to tone bursts with frequencies above 24 kHz. CAP latencies increased for all frequencies tested (2 to 40 kHz). Cooling to lower temperatures produced larger latency increases and greater threshold shifts which extended to CAPs evoked by frequencies as low as 16 kHz. These CAP changes were fully reversible after a cochlear temperature of 38°C was restored. In an attempt to create more uniform cooling of the cochlea, experiments were also conducted with round window thermocouples chronically implanted in guinea pigs. After cooling the entire anesthetized animal to 36°C, CAP thresholds were again elevated only for frequencies above 24 kHz. In other acute experiments, extracellular DC receptor potentials were recorded from the organ of Corti with micropipettes. Cooling caused a decreased sensitivity to tones at the characteristic frequency of the recording location (20 kHz) and had less effect on responses to lower frequencies. The receptor potential usually recovered after rewarming the cochlea. These data emphasize that temperature is an important parameter when electrophysiological measurements are being made. They also suggest an explanation for the reported discrepancy between behavioral and electrophysiological thresholds at high frequencies. (38 refs.)

73592 **Comparison of click responses of primary auditory fibers with minimum-phase predictions.** C.D.Geisler, D.G.Sinex (Dept. of Neurophysiology, Univ. of Wisconsin, Madison, WI, USA).

J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1671-6 (May 1983).

Minimum-phase impulse responses were constructed from the frequency threshold-response curves of primary auditory fibers in the anesthetized cat. These impulse responses had many of the same characteristics as the experimental click responses. The two types of responses had similar interpeak intervals as well as similar (±1.5 ms) latencies to the principal mode and similar (±1.0 ms) intervals from response onset to the principal mode. (20 refs.)

73593 **Target detection in reverberation by an echolocating Atlantic bottlenose dolphin (Tursiops truncatus).** W.W.L.Au, C.W.Turl (Naval Ocean Systems Center, Kailua, HI, USA).

J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1676-81 (May 1983).

An experiment was conducted to determine the ability of an echolocating Atalantic bottlenose dolphin (Tursiops truncatus) to detect targets in the presence of reverberation. Reverberation was induced by a clutter screen consisting of forty-eight 5.1-cm-diam cork spheres spaced 15.2 cm apart and arranged in a rectangular array, located behind the targets. Hollow aluminium cylinders having the same outer diameter and wall thickness and three different lengths were used as targets. The dolphin was trained to station in a hoop, 6 m from the targets, and to echolocate the target upon the reception of an audio cue. Only one of the targets would be presented in a target-present trial. Data were collected on the animal's detection of performance as a function of the separation distance between the clutter screen and the targets. The animal's performance for the smallest cylinder varied from 91% to 55% correct as the separation distance decreased from 10.2 to 0 cm. The target strength of the clutter screen and the cylinders were measured both in terms of the energies and the maximum peak-to-peak amplitudes of the incident and reflected echoes. These measurements indicated that when the target-clutter screen separation distances was 0 cm, the dolphin's 50% correct detection occurred at an energy echo-to-reverberation ratio of approximately 0.25 dB and at a peak-to-peak echo-to-reverberation ratio of 2.6 dB. The results also indicated that the dolphin's pulse emissions were monitored by a microprocessor system and the results are presented in terms of the average number of clicks and the average response latency, as a function of the separation distance. (18 refs.)

73594 **Forward masking patterns for harmonic complex tones.** B.C.J.Moore, B.R.Glasberg (Dept. of Experimental Psychology, Univ. of Cambridge, Cambridge, England).

J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1682-5 (May 1983).

Complex tones containing the first ten harmonics at equal amplitude, and with fundamental frequencies of 100, 200, or 400 Hz, served as maskers for brief sinusoidal signals (10-, 20-, or 40-ms duration) presented immediately following the maskers. Threshold was measured as a function of signal frequency, using an adaptive, two-alternative forced-choice procedure. The starting phase of the signal relative to the masker had no significant effect on threshold. The masking patterns showed clear peaks corresponding to the first 3 or 4 harmonics, but no peaks were visible for higher harmonics. It is concluded that the 'ripple' in the internal spectra of the maskers amounts to 3 dB or less for harmonics above the fifth. (14 refs.)

73595 **The origin of tonality and a possible explanation of the octave enlargement phenomenon.** K.Ohgushi (NHK Broadcasting Sci. Res. Lab., Tokyo, Japan).

J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1694-700 (May 1983).

It is known that the subjective octave is slightly larger than the physical octave (=2) for a variety of tones. This paper presents a new idea about the physiological origin of totality, and a new theory founded on recent knowledge of the auditory physiology, to explain the octave enlargement phenomenon for pure tones. The theory's predictions of the subjective octave agree well with psychophysical data. (36 refs.)

73596 **Pitch of narrow-band signals.** L.J.Stover, L.L.Feth (Audiology & Speech Sci., Purdue Univ., West Lafayette, IN, USA).

J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1701-7 (May 1983).

This study investigated the pitch elicited by complex narrow bandwidth signals. These signals ranged from two-component tones to multiple-component approximations of narrow-band noise. All were contained with 10-, 20-, or 50-Hz bandwidths. Listeners were asked to adjust the frequency of a pure tone to match the pitch they heard in a given complex signal. A simple model suggests that the pitch of these complex signals should match that a pure tone set to the center frequency. For a majority of the signals, the performance of three of four listeners were not different from the model predictions. However, the two-component signals were apparently resolved and two simultaneous pitches were heard by some listeners. The fourth listener heard two sequential pitches in many of the complex signals. The authors are unable to account for the performance although the pitch matches were very repeatable. These results have implications for an understanding of pitch coding and auditory spectral resolution. (17 refs.)

73597 Detection of interaural differences of intensity in trains of high-frequency clicks as a function of interclick interval and number. E.R.Hafter, R.H.Dye,Jr., E.Wenzel (Dept. of Psychology, Univ. of California, Berkeley, CA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1708-13 (May 1983).
Listeners were asked to detect interaural differences of intensity in trains of 4000-Hz clicks as the interclick interval (ICI) was varied from 10 to 1 ms and the number of clicks in a train (*n*) was varied from 1 to 32. As has previously been shown for differences of time [Hafter and Dye, ibid., vol. p.72, 6440-651, 1983], plots of log interaural thresholds versus log *n* produced slopes that decrease with ICI. These results are explained in terms of a saturation model which argues that as the click rate increases, the evoked neural activity changes from what is essentially a tonic response toward one that is more plastic. (33 refs.)

73598 Interaural time and amplitude discrimination in noise. R.M.Stern,Jr., J.E.Slocum, M.S.Phillips (Dept. of Electrical Engng., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1714-22 (May 1983).
Just-noticeable differences (JNDS) of both interaural time delay (ITD) and interaural intensity difference (IID) were measured for binaural tones in the presence of broadband maskers. The tones were presented at 50 dB SPL, the target frequency was 500 Hz, and the masker frequency was 100-1000 Hz, with various combinations of ITD and IID. The time and amplitude JNDs exhibit similar dependencies on target-to-masker ratio and masker type. At a given target-to-masker ratio, discrimination was generally best in the presence of diotic maskers and worst in the presence of the interaurally out-of-phase maskers. Results for the other masker types examined tended to fall in between these two extremes. Many of these data trends are consistent with predictions of the lateralization model and the position-variable model based on auditory-nerve activity. (40 refs.)

73599 Traffic noise annoyance and noise sensitivity in persons with normal and impaired hearing. G.Aniansson, K.Pettersson, Y.Peterson (ENT Dept., Univ. of Goteborg, Goteborg, Sweden).
J. Sound & Vib. (GB), vol.88, no.1, p.85-97 (8 May 1983).
A laboratory study was undertaken to investigate annoyance caused by traffic noise among persons with normal hearing and impaired hearing. The impaired hearing groups are representative of about 10% of the population in Sweden with similar or poorer hearing acuity. Groups with different hearing ability were exposed to 45 dB(A) and 55 dB(A) traffic noise when engaged in four activities, in which noise did or did not interfere with speech. The annoyance ratings were higher for the impaired hearing groups at 45 dB(A) with 55 dB(A) in the activities in which noise did interfere with speech. The greatest differences were found between men with noise-induced hearing loss and men with normal hearing. The results revealed a higher sensitivity to noise in one of the noise-induced hearing loss groups compared with men with normal hearing as well as in females compared with males in groups with and without hearing impairment. Changes in mood after a 2 h exposure to 45 dB(A) and 55 dB(a) traffic noise were also found. Pleasantness and activation decreased after exposure when all subjects were taken as one sample. (29 refs.)

73600 Traffic noise annoyance and speech intelligibility in persons with normal and persons with impaired hearing. G.Aniansson (ENT Dept., Univ. of Goteborg, Goteborg, Sweden), M.Bjorkman.
J. Sound & Vib. (GB), vol.88, no.1, p.99-106 (8 May 1983).
Annoyance ratings in speech intelligibility tests at 45 dB(A) and 55 dB(A) traffic noise were investigated in a laboratory study. Subjects were chosen according to their hearing acuity to be representative of 70-year-old men and women, and of noise-induced hearing losses typical for a great number of industrial workers. These groups were compared with normal hearing subjects of the same sex and, when possible, the same age. The subjects rated their annoyance on an open 100 mm scale. Significant correlations were found between annoyance expressed in millimetres and speech intelligibility in percent when all subjects were taken as one sample. Speech intelligibility was also calculated from physical measurements of speech and noise by using the articulation index method. Observed and calculated speech intelligibility scores are compared and discussed. Also treated is the estimation of annoyance by traffic noise at moderate noise levels via speech intelligibility scores. (20 refs.)

73601 A quasi-3D model of the spirally coiled cochlea. C.H.Loh (Dept. of Theoretical & Appl. Mech., Auckland Univ., Auckland, New Zealand).
Mech. Res. Commun. (GB), vol.10, no.1, p.15-19 (Jan.-Feb. 1983).
The cochlea is the innermost organ of the peripheral auditory system. It is a spirally-coiled cavity filled with an incompressible fluid with a mechanical piston (stapes) located at one end. The cavity consists of two chambers separated by a partition, a portion of which is flexible and the remainder rigid. The flexible portion, named the basilar membrane (BM), is a shell of increasing width and decreasing elastic stiffness. Its deflection is controlled by the pressure difference across the partition. Present models of the cochlea do not include the spiral coiling. The present analysis includes the curvature and attempts to solve the commitant equations using a quasi-3D version of the WKB method. (2 refs.)

73602 Cochlear effects of cryosurgery. M.Suzuki (Dept. of Otolaryngology, Hiroshima Univ., Hiroshima, Japan), I.M.Hunter-Duvar.
Scanning Electron Microsc. (USA), pt.3, p.1295-300 (1982).
A total of 21 cochleas in 13 chinchillas were treated with cryosurgery and the damage to the organ of Corti was evaluated with the scanning electron microscope. The apical half-turn was treated in 11 of the cochleas and the basal half-turn in 10. Apical exposure to the cryoprobe generally resulted in severe damage to sensory cells in the apical turn whereas basal turn exposure generally resulted in mild damage to sensory cells in the basal turn. On occasion severe damage from apical turn exposure resulted in severe damage that extended to the basal turn. First row outer hair cells were the most susceptible to damage and inner hair cells least susceptible. (9 refs.)

73603 Comparative morphological features of the caecilian inner ear with comments on the evolution of amphibian auditory structures. J.S.White, I.L.Baird (Dept. of Anatomy, Creighton Univ. School of Medicine, Omaha, NE, USA).
Scanning Electron Microsc. (USA), pt.3, p.1301-12 (1982).
Comparative fine structural studies of amphibian auditory structures in urodeles have been extended to include examination of the papilliform endorgans (amphibian, neglecta and basilar) that variably occur in species selected from three families of caecilians (Gymnophiona). The species investigated were Ichthyophis kohtaoensis (Ichthyophiidae), Dermophis mexicanus (Caeciliidae) and Typhlonectes natans (Typhlonectidae). Ichthyophis is the only form to display all three papillae; both Dermophis and Typhlonectes lack a basilar papilla but all three species show both neglecta and amphibiorum. In these forms, the amphibian papilla contained the most sensory cells with ciliary bundles organized into two proximal and distal groups polarized toward a mid-line papillar axis. The papilla neglecta contained slightly fewer sensory cells and ciliary bundles oriented predominantly posteriorly. In Ichthyophis, the basilar papilla contained the lowest sensory cell counts of any papilla. (38 refs.)

Visual and auditory anomalies in Chediak-Higashi syndrome .. See Entry 73563

Effect of formant transition time on the perception of the voiced stop consonants .... See Entry 73607

The polarity histogram in relation to the average evoked potential .... See Entry 73676

Microcomputer-controlled psychoacoustics in clinical audiology .... See Entry 73681

Reflex inhibition procedures for animal audiometry: a technique for assessing ototoxicity .... See Entry 73699

87.36 SPEECH

(see also 43.70 Speech communication)

73604 Relationships between vocal intensity and noninvasively obtained aerodynamic parameters in normal subjects. S.Tanaka, W.J.Gould (Vocal Dynamics Lab., Lenox Hill Hospital, New York, NY, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1316-21 (April 1983).
The relationships between vocal intensity (sound pressure level) and intrapulmonic pressure, mean flow rate, and aerodynamic power were investigated in ten normal subjects. The intrapulmonic pressure was measured noninvasively and simultaneously with sound pressure level and mean flow rate during sustained phonation of the vowel /a/ by means of plethysmographic and pneumotachographic methods. The aerodynamic power was calculated as intrapulmonic pressure times mean flow rate. The averaged values for the normal subjects represented $(\text{sound power}) \propto (\text{intrapulmonic pressure})^{3.18}$, $(\text{sound power}) \propto (\text{mean flow rate})^{9.62}$, and $(\text{sound power}) \propto (\text{aerodynamic power})^{2.44}$, where sound power at the open end of the pneumotachograph was estimated from sound pressure level. Vocal efficiency was defined as the ratio of sound power to aerodynamic power. Individual variation of vocal efficiency (in dB) was satisfactorily small in the normal subjects, and was determined by the simple addition of individual variations of intrapulmonic pressure and mean flow rate (in dB) from the average values. These findings strongly suggested that the comparison of those measurements against normative data for normal subjects such as provided by this study is useful in evaluating and clarifying the ineffective voice production of the pathological larynx. (17 refs.)

73605 Enlargement of the supraglottal cavity and its relation to stop consonant voicing. J.R.Westbury (Dental Res. Center, Univ. of North Carolina, Chapel Hill, NC, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1322-36 (April 1983).
Measurements were made of sagittal plane movements of the larynx, soft palate, and portions of the tongue from a high-speed cinefluorographic film of utterances produced by one adult male speaker of American English. These measures were then used to approximate the temporal variations in supraglottal cavity volume during the closures of voiced and voiceless stop consonants. All data were subsequently related to a synchronous acoustic recording of the utterances. Instances of /p,t,k/ were always accompanied by silent closures, and sometimes accompanied by decreases in supraglottal volume. In contrast, instances of /b,d,g/ were always accompanied both by significant intervals of vocal fold vibration during closure, and relatively large increases in supraglottal volume. However, the magnitudes of volume increments during the voiced stops, and the means by which those increments were achieved, differed considerably across place of articulation and phonetic environment. These results are discussed in the context of a well-known model of the breath-stream control mechanism, and their relevance for a general theory of speech motor control is considered. (41 refs.)

73606 Acoustic and perceptual indicators of emotional stress. L.A.Streeter (Crawford Hill Lab., Bell Labs., Holmdel, NJ, USA), N.H.Macdonald, W.Apple, R.M.Krauss, K.M.Galotti.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1354-60 (April 1983).
Tape recordings of telephone conversations of Consolidated Edison's system operator (SO) and his immediate superior (CSO), beginning an hour before the 1977 New York Blackout, were analyzed for indications of psychological stress. (SO was responsible for monitoring and switching power loads within the Con Ed network.) Utterances from the two individuals were analyzed to yield several pitch and amplitude statistics. To assess the perceptual correlates of stress, four groups of listeners used a seven-point scale to rate the stress of SO and CSO from either randomized vocal utterances or transcripts of the randomized utterances. Results indicated that whereas CSO's vocal pitch increased significantly with increased situational stress, SO's pitch decreased. Listener ratings of stress from the voice were positively related to average pitch. It appears that listeners' stereotype of psychological stress includes elevated pitch and amplitude levels, as well as their increased variability. (15 refs.)

73607 Effect of formant transition time on the perception of the voiced stop consonants. H.Nakashima, O.Kakusho (Inst. of Sci. & Industrial Res., Osaka Univ., Ibaraki, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.1, p.52-3 (Jan. 1983). In Japanese. (9 refs.)

Laryngeal vibrations: a comparison between high-speed filming and glottographic techniques .... See Entry 71311

Reiterant speech: an acoustic and perceptual validation .... See Entry 71312

Place cues for nasal consonants with special reference to Catalan .... See Entry 71313

Computerized measurement of tongue dorsum movements with pulsed-echo ultrasound .... See Entry 73698

87.38 MECHANO- AND CHEMIO-CEPTIONS

(inc. biosonic generation, detection and guidance)

73608 Spinal and early scalp-recorded components of the somatosensory evoked potential following stimulation of the posterior tibial nerve. M.Seyal, R.G.Emerson, T.A.Pedley (Neurological Inst., Columbia Univ. Coll. of Physicians & Surgeons, New York, NY, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.320-30 (March 1983).
Somatosensory evoked potentials (SEPs) were elicited by stimulation of the posterior tibial nerve (PTN) in 12 normal adults. Recording using both cephalic and non-cephalic references were obtained from multiple electrodes placed over the spine and scalp. Following PTN stimulation, the fastest recorded potentials of the afferent sensory volley proceeds up the spinal cord at constant velocity. After arrival of the volley at cervical cord levels, 3 widely distributed waves, P_{28}, P_{31} and N_{34}, are recorded from scalp electrodes. These 'far-field' potentials are followed by a localized positivity (P_{38}) which has a peak voltage either at the vertex or just laterally toward the side of stimulation. A contralateral negativity (N_{38}) was present in most individuals. It is proposed that P_{28} arises from medial lemniscus; that P_{31} is generated by ventrobasal thalamus; and that N_{34} is probably the result of further activity in thalamus and/or thalamocortical radiations. (27 refs.)

73609 Vibrotactile masking of Pacinian and non-Pacinian channels. R.D.Hamer, R.T.Verrillo, J.J.Zwislocki (Inst. for Sensory Res., Syracuse Univ., Syracuse, NY, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1293-303 (April 1983).
Vibrotactile masking functions were determined using sinusoidal and noise maskers. Results were nearly identical within the Pacinian (P) and non-Pacinian (NP) channels. At low masker SLs there was a substantial amount of negative masking which proved not to be an artifact of stimulus definition. The critical parameters for successful prediction of the data were a peripheral threshold and internal Gaussian noise. Threshold shifts in cross-channel stimulation can be attributed to the masker exceeding the detection threshold of the signal channel. (51 refs.)

Target detection in reverberation by an echolocating Atlantic bottlenose dolphin (Tursiops truncatus) ....See Entry 73593

Discriminating somatic evoked potentials using a pairwise procedure ....See Entry 73675

87.40 BIOMAGNETISM

(inc. magnetocardiography)

Effects of cross relaxation on the analysis of T_1 data in paramagnetic proteins ....See Entry 70909

Fibrinogen and fibrin structure and fibrin formation measured by using magnetic orientation ....See Entry 73523

Temperature dependence of the ^{1}H-n.m.r. spectrum of hydrated collagen ....See Entry 73527

Nuclear magnetic relaxivity of chloroplast thylakoid membranes: response to saturating light flashes ....See Entry 73532

Why is proton magnetic relaxation delayed in tumour cells? ..See Entry 73544

On the possibility to determine integral characteristics of the cardiac electric generator from extracardiac electric and magnetic measurements ....See Entry 73559

Absence of the influence of a magnetic field on Na^+, K^+-dependent ATPase ....See Entry 73627

Glass-ceramic-mediated, magnetic-field-induced localized hyperthermia: response of a murine mammary carcinoma ....See Entry 73629

Optimal field for detection of magnetically labeled blood ....See Entry 73650

A low-noise low input impedance amplifier for magnetic measurements of nerve action currents ....See Entry 73694

87.45 BIOMECHANICS, BIORHEOLOGY, BIOLOGICAL FLUID DYNAMICS

73610 An analysis of the stress field of human knee joint. Wu Wen-zhou, Sun Jue (Taiyuan Polytech. Inst., China).
Acta Mech. Solida Sin. (China), no.3, p.296-301 (1981). In Chinese.
A two-dimensional built-up structure model consisting of plates of different material constants is developed for the human knee. The finite element method is adopted to analyse the stress field. The results obtained are: a) for the tibial plateau, both the maximum compressive and maximum shear stress are on the lateral plateau; b) the surface load on the subchondral bone of femur is transmitted almost directly to the subchondral bone of tibia; c) the stress distribution in the articular cartilage is uniform; d) the effect of the lubricant liquid is not taken account of, but the results obtained show that there is practically no shear stress on the tibio-femoral contact surface. (7 refs.)

73611 Relation between lung mechanics, hemodynamics and regional distribution of blood flow and ventilation in left to right intracardiac shunt. P.Zardini, C.Bucca, G.Rolla (Univ. di Torino, Turin, Italy).
J. Nucl. Med. & Allied Sci. (Italy), vol.27, no.1, p.1-8 (Jan.-March 1983).
14 patients with congenital left to right intracardiac shunt were investigated by the ^{133}Xe technique. The patients were without any other cardiac or pulmonary disease which could affect the pathophysiologic conditions of their central circulation. From the results obtained, it appears that pulmonary hyperfusion alone produces an early closure of small airways and a rather variable pattern of distribution of intrapulmonary blood flow, while when it is complicated by pulmonary hypertension, it impairs lung compliance and small airway caliber and causes a diversion of blood flow toward the apex of the lung. (22 refs.)

73612 Flow visualization in isolated transparent natural blood vessels. T.Karino, M.Motomiya (McGill Univ. Medical Clinic, Montreal General Hospital, Montreal, Quebec, Canada).
Biorheology (GB), vol.20, no.2, p.119-27 (1983).
A novel technique to prepare isolated transparent natural blood vessels was developed and used to study the detailed flow patterns in some regions of the circulation. It was found that paired spiral secondary flows and recirculation zones form downstream of venous valves, at the arterial T-junctions in the dog abdominal aorta, and in the human carotid sinus over a wide range of geometrical and flow conditions, including the time-averaged mean values of the physiological flow rates. (17 refs.)

73613 A theoretical analysis of the effects of varying fibrinogen concentration and haematocrit on the flow characteristics of blood in cylindrical tubes. M.W.Rampling, T.Challoner (Dept. of Biophysics & Neurology, St. Mary's Hospital Medical School, London, England).
Biorheology (GB), vol.20, no.2, p.141-52 (1983).
The viscosity/shear rate relationship of whole blood is shown to be described to a good approximation by a bilinear plot on log/log axes. This has allowed an analytical solution to be obtained which gives a full description of the flow properties of blood in rigid tubes of a size where the Fahraeus-Lindqvist effect is minimal. As a result the profound effects that changing haematocrit has on blood flow in such tubes can be quantitated. The analysis also shows that in similar circumstances altering fibrinogen concentration is of rheological significance only at flow rates below the normal physiological range. (13 refs.)

73614 Peristaltic transport of a physiological fluid. I. Flow in non-uniform geometry. L.M.Srivastava (Dept. of Maths., Univ. of Liberia, Monrovia, Liberia), V.P.Srivastava, S.N.Sinha.
Biorheology (GB), vol.20, no.2, p.153-66 (1983).
The problem of peristaltic transport of a fluid of variable viscosity in a non-uniform tube and channel has been investigated under zero Reynolds number conditions, and in the long wavelength approximation. It is found that the pressure decrease as the fluid viscosity decreases at zero flow rate is independent of viscosity variation at a certain value of flow rate. The pressure increases if the flow rate increases from this value. The difference between two corresponding values (for constant and variable viscosity) of pressure rise, under a given set of conditions, increases with increasing amplitude ratio at zero flow rate. Further, for a given zero pressure rise, the flow rate increases as the viscosity of the fluid decreases. The pressure rise, in the case of non-uniform geometry, is found to be much smaller than the corresponding value in the case of uniform geometry. (54 refs.)

73615 Peristaltic transport of a physiological fluid. II. Flow in uniform geometry. L.M.Srivastava (Dept. of Maths., Univ. of Liberia, Monrovia, Liberia), V.P.Srivastava, S.N.Sinha.
Biorheology (GB), vol.20, no.2, p.167-78 (1983).
For pt.I see ibid., vol.20, no.2, p.153-66, 1983. Using the model of peristaltic flow in non-uniform geometry, developed in pt.I, results for uniform tube and channel are obtained in closed form. Comparison of analysis with other theories and the effect of viscosity variation are discussed in detail. Finally, quantitative comparisons are made between theory and experiments of Weinberg et al. (1971) and Latham (1966). (11 refs.)

73616 Peristaltic transport of a physiological fluid. III. Applications. L.M.Srivastava (Dept. of Maths., Univ. of Liberia, Monrovia, Liberia), V.P.Srivastava, S.N.Sinha.
Biorheology (GB), vol.20, no.2, p.179-86 (1983).
For pt.II see ibid., vol.20, no.2, p.167-78, 1983. The models of peristaltic flow in non-uniform and uniform tube and channel, developed in pts.I and II are applied and compared with the observed flow rates in the vas deferens of rhesus monkeys, the small intestine, and the ductus efferentes of the male reproductive tract. (23 refs.)

73617 Development of a rheological constitutive relation for a soft biological tissue. M.G.Sharma, S.Rafie (Pennsylvania State Univ., University Park, PA, USA).
Biorheology (GB), vol.20, no.2, p.187-97 (1983).
A rheological constitutive relation in shear for an apple cortex tissue has been developed based upon creep experiments on solid cylindrical samples of the soft tissue obtained from a specified location of the apple and subjected to constant torques of various magnitudes and duration using a specially developed multiaxial loading device. Results indicate that the material displays nonlinear viscoelastic properties which can be characterized by a multiple integral relation between the torque and the unit angle of twist. Using this relation the creep response of the material under two step and three step torque histories and the history with torque linearly varying with time was predicted and found to agree well with experimental results. A method is described for obtaining the constitutive relation in shear from the developed unit angle of twist-torque equation. The shear constitutive relation for the tissue has been found to be of the integral type with two kernal functions specifying the rheological response. (13 refs.)

73618 Biorheological matching: mucociliary interaction and epithelial clearance. A.Silberberg (Polymer Res. Dept., Weizmann Inst. of Sci., Rehovot, Israel).
Biorheology (GB), vol.20, no.2, p.215-22 (1983). (Proceedings of the Fourth International Congress of Biorheology, Tokyo, Japan, 27 July-1 Aug. 1981).
In mucociliary clearance mucus has been found to be essential as coupler between ciliary beat and transport. The rheological properties of mucus are carefully matched to this task. It has to be an incipient gel and deviations from this state to a sol or to a stiff gel both render it defective in function. The known rheological properties of normal mucus are shown to be consistent with one's understanding of how a periodically interacting set of cilia produce mucus layer flow. A dual requirement has to be met: adequate tip penetration and adequae force transfer laterally. As a result any biorheologically properly matched system can replace mucus. Mucociliary clearance is a clear cut, rather well understood case of a general principle of biorheological matching. (5 refs.)

73619 Frequency distribution of viscoelastic properties of sputum studied by the raised cosine pulse method: the effects of mucolytic agents. T.Okubo, S.Shimura, T.Takishima (First Dept. of Internal Medicine, Tohoku Univ. School of Medicine, Sendai, Japan), Y.Otubo, K.Umeya.
Biorheology (GB), vol.20, no.2, p.231-8 (1983). (Proceedings of the Fourth International Congress of Biorheology, Tokyo, Japan, 27 July-1 Aug. 1981).
Reports studies on the frequency dependence of the viscoelastic behavior of human sputum using the authors' newly developed raised cosine pulse (RCP) method. This method needs only 1.5 ml sputum, and allows one to estimate the responses of storage modulus (G′) and loss modulus (G″) to the change of angular frequency $\omega=10^{-3}$-10^{0} rad. sec^{-1} in only 2-3 minutes by applying one small pulse strain. Measurements were made at 37°C and within 2 hours of expulsion. The results obtained by the RCP method and by a conventional method were compared and were roughly in agreement. From the behavior of G′ and G″, the presence of a relaxation region at $\omega=3\times10^{-2}$-3×10^{-1} rad. sec^{-1} could be deduced. The magnitude of relaxation increased and relaxation frequencies decreased, as the purulence of sputum increased. The authors also observed differences in viscoelastic behavior of sputum resulting from the application of mucolytic agents in vivo, which suggest corresponding changes of mechanical structures to the different pharmacological actions of these drugs. (10 refs.)

73620 Spinability of bronchial mucus. Relationship with viscoelasticity and mucous transport properties. E.Puchelle, J.M.Zahm, C.Duvivier (Unite de Physiopathologie Respiratoire, INSERM, Vandoeuvre-les-Nancy, France).
Biorheology (GB), vol.20, no.2, p.239-49 (1983). (Proceedings of the Fourth International Congress of Biorheology, Tokyo, Japan, 27 July-1 Aug. 1981).
Spinability of normal mucus and of sputum collected in chronic bronchitic patients was measured using an automatic device derived from that developed by Chretien et al. (1977) for cervical mucus. Spinability of sputum decreased as the purulence increased. Although significant correlations were found between spinability and apparent viscosity ($r=-0.50$, $p<0.05$) or elasticity ($r=0.54$, $p<0.02$), large variations in spinability were observed for sputum samples ranging in a zone of low viscosity and elasticity. Sputum with high spinability exhibited normal transport rate on the depleted frog palate although their viscosity and elasticity were abnormally low. The significant correlation obtained between spinability and sputum transport rate ($r=0.61$, $p<0.01$) suggests that this rheological factor, along with viscosity and elasticity, plays an important role in the mucociliary transport mechanism. (18 refs.)

73621 Mucociliary clearance in chronic sinusitis: related human nasal clearance and in vitro bullfrog palate clearance. Y.Majima, Y.Sakakura, T.Matsubara, S.Murai, Y.Miyoshi (Dept. of Otolaryngology, Mie Univ. School of Medicine, Mie, Japan).
Biorheology (GB), vol.20, no.2, p.251-62 (1983). (Proceedings of the Fourth International Congress of Biorheology, Tokyo, Japan, 27 July-1 Aug. 1981).
Nasal mucociliary clearance was measured in both healthy subjects and in patients with chronic sinusitis using the saccharin granule technique. Nasal mucociliary transit time (ST) was significantly slower in the patients with chronic sinusitis compared with that in controls ($p<0.005$). Nasal mucus collected from each nasal cavity was used for in vitro bullfrog palate clearance studies and compared to the in vivo nasal ST. The mucociliary clearance rate (MTR) on the frog palate was 12.5 ± 2.5 mm/min in the mucus from control subjects, and 6.1 ± 1.5 mm/min in the mucus from the patients. The difference was statistically significant ($p<0.005$). The MTR on the frog palate in the patients whose nasal ST was within the normal range was significantly slower than that in the controls ($p<0.005$), but not significantly different from that in the patients whose nasal ST was over the normal range. These results suggest that the nasal mucous properties which decreased the mucociliary clearance on the frog palate did not contribute to the mucociliary clearance of the patients who had a normal mucociliary clearance. (23 refs.)

73622 The physics of arteriole blood flow. I. General theory. E.A.Trowbridge (Dept. of Appl. & Computational Maths., Univ. of Sheffield, Sheffield, England).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.151-75 (May 1983).
A continuum physics theory of arteriole blood flow is presented based on the observed behaviour of blood using high-speed photography. The theory highlights the importance of time scales as well as length scales in constructing a physical theory of blood flow. Arteriole flow viewed at 8000 frames s^{-1} reveals a highly complicated cellular motion; however the same flow viewed at the same spatial magnification by the human sensor, the eye, reveals ony a pinkish column of fluid. The eye 'smoothes out' the microscopic cellular behaviour. This principle is used in the continuum theory, where averages are taken over space and time, to explain how the observed collisions of the erythrocytes with themselves, plasma molecules and the arteriole wall determine blood, mass-averaged velocity profiles and mass flow rates. A new dimensionless similarity parameter arises from the continuum mixture. Its magnitude provides a measure of the relative importance of the viscous drag of a constituent and the frictional force experienced by one constituent due to the presence of another constituent in the mixture during arteriole blood flow. (14 refs.)

73623 The physics of arteriole blood flow. II. Comparison with experiment. E.A.Trowbridge, P.M.Meadowcroft (Dept. of Appl. & Computational Maths., Univ. of Sheffield, Sheffield, England).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.177-96 (May 1983).
For pt.I see ibid., vol.4, no.2, p.151-75, 1983. The results of pt.I are used to explain, using a continuum physics approximation, some of the experimentally observed phenomena which appear in the literature. The magnitude of the new dimensionless similarity parameter which arises from the mixture theory indicates that the internal frictional force acting on the plasma due to the presence of the erythrocytes (with an equal and opposite force acting on the erythrocytes due to the plasma) dominates the internal plasma viscous force. It is this feature that produces the observed slower flow rate of blood compared with water for a given pressure gradient. Quantitative predictions, which agree with experiment, of the cell-free layer, feed, dynamic and discharge haematocrits for cylindrical pipe flow are obtained. The observed decrease in apparent blood viscosity with decrease in cylinder diameter is also predicted. Finally an explanation is presented for the experimental observation of an off-centre peak in the tube radial viscosity profile. (21 refs.)

73624 Electromechanical and physicochemical properties of connective tissue. A.J.Grodzinsky (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
CRC Crit. Rev. Biomed. Eng. (USA), vol.9, no.2, p.133-99 (1983).
Connective tissues are one of a class of biological materials that exhibit electromechanical transduction behavior. This behavior involves fields that are intrinsic to the ionized macromolecules that make up the material, as well as the interactions between externally applied fields and these ionized macromolecules. Recent interest has focused on the importance of electrical forces to the structure-property-function relationships in normal and diseased connective tissues. In addition, current clinical use of electromagnetic fields to induce growth and remodeling of connective tissues motivates the necessity to understand transduction between electrical, chemical, and mechanical subsystems at the molecular level. After a brief review of the composition and ultrastructure of representative connective tissues, recent research on the macromolecular basis of electromechanical transduction is discussed. The influence of electromechanical forces on transport processes in extracellular matrices is reviewed. Finally, current concepts of the significance of electromechanical transduction in the function of natural tissues and artificial replacement materials are summarized. (260 refs.)

73625 Is bone a Cosserat solid?. H.S.Yoon, J.L.Katz (Dept. of Biomedical Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Mater. Sci. (GB), vol.18, no.5, p.1297-305 (May 1983).
In a viscoelastic composite material including bone, acoustic waves undergo both geometric and viscoelastic dispersions as they propagate through the medium. The viscoelastic dispersion is characterized by an increase in phase velocity with increase in frequency, while the geometric dispersion is well-known. By comparing the dispersion data on these and other types of materials, it has been noted that the increases in the ultrasonic velocities for bones are much larger than those for simple viscoelastic solids and composites, suggesting an additional dispersion mechanism. This additional dispersion can be explained by Mindlin's theory (1963) on the Cosserat continuum with microstructure. (52 refs.)

73626 Correlation between walking energy expenditure and tachographic gait parameters. D.N.Tibarewala, S.Ganguli (Coll. of Medicine, Univ. of Calcutta, Calcutta, India).
J. Med. Eng. & Technol. (GB), vol.7, no.2, p.58-65 (March-April 1983).
A group of 53 adult men, normal subjects as well as victims of different types of lower-extremity handicaps, took part in tachographic gait studies and measurements of physiological energy expenditure whilst walking at a self-selected pace. The observations were analysed to explore the relationships between walking energy expenditure and various gait parameters. This analysis allowed the authors to identify some biomechanical indices which can be used for objective evaluations of human performance in locomotion. (14 refs.)

Theory and experiment on the three-dimensional motion of a freely suspended spherical particle at the entrance to a pore at low Reynolds number .... See Entry 71637

Settling of fixed erythrocyte suspension droplets .... See Entry 73545

Mechanical fatigue as a possible determinant of in vivo longevity of red blood cells .... See Entry 73547

Relationships between vocal intensity and noninvasively obtained aerodynamic parameters in normal subjects .... See Entry 73604

Discrete time estimation of the mean Doppler frequency in ultrasonic blood velocity measurements .... See Entry 73647

Optimal field for detection of magnetically labeled blood .... See Entry 73650

Changes in the loco-regional cerebral blood flow (r.CBF) during a simulation of weightlessness .... See Entry 73670

Pressure-derived flow: a new method .... See Entry 73677

Evaluation of blood-pressure transducers .... See Entry 73680

Hydraulic evaluation of heart prosthetic valves (in case of mechanical valve) .... See Entry 73686

Erythrocyte filtrability measurement by the initial flow rate method .... See Entry 73690

Water diffusion and measurement of cerebral blood flow by $C^{15}O_2$ inhalation .... See Entry 73697

87.50 BIOLOGICAL EFFECTS OF RADIATIONS

(inc. effects of fields)

73627 Absence of the influence of a magnetic field on Na^+, K^+-dependent ATPase. M.L.Savich, M.V.Shcheglova, L.M.Paikham, A.N.Kuznetsov (Res. Inst. for the Biological Testing of Chem. Compounds, Kupavna, USSR).
Biophysics (GB), vol.27, no.3, p.549-51 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.532-3 (1982).
Previous work has indicated the possibility of a direct action of a magnetic field on Na^+, K^+-ATPase. The authors investigated a membrane preparation of Na^+, K^+-ATPase isolated from the grey matter of bovine brain. Their results indicate that a magnetic field up to 1500 mT does not influence the isolated membrane preparation of Na^+, K^+-ATPase. The effect of a magnetic field on active transport in the tissues previously observed (Bresler et al., 1978, Bresler and Bresler, 1974) is apparently due to the influence of the field not on transport Na^+, K^+-ATPase but on certain regulators of its activity. (8 refs.)

73628 New conclusions on the avoidance of danger from electromagnetic fields in the region of high-power radio transmitters. M.Dahme (Inst. fur Rundfunktech. GmbH, Munchen, Germany).
NTG-Fachber. (Germany), vol.83, p.109-18 (1983). In German. (Horrundfunk 6 (Sound Broadcasting), Mannheim, Germany, 23-25 Nov. 1982).
For the estimation of the immediate danger to persons by electromagnetic fields, two general concepts are applied-for frequencies below 30 kHz danger from the effect of the alternating field on the nerve cells, and for frequencies above 2 MHz danger of damage by heating effects; between 30 kHz and 2 MHz both risks are present. A review is given of present knowledge of the absorption effect on the human body, with a comparison of the different methods of assessing the specific absorption rate. A further hazard may be the ignition of explosive mixtures by electromagnetic fields. (6 refs.) *A.G.P.*

73629 Glass-ceramic-mediated, magnetic-field-induced localized hyperthermia: response of a murine mammary carcinoma. A.A.Luderer (Research & Dev. Labs., Corning Glass Works, Corning, NY, USA), N.F.Borrelli, J.N.Panzarino, G.R.Mansfield, D.M.Hess, J.L.Brown, E.H.Barnett, E.W.Hahn.
Radiat. Res. (USA), vol.94, no.1, p.190-8 (April 1983).
Hyperthermia has been found to be a useful modality for cancer therapy. In this report, a biocompatible, ferrimagnetic glass-ceramic capable of inducing localized hyperthermia by hysteresis heating upon exposure to an alternating magnetic field is presented. When the glass-ceramic was placed in the region of a subcutaneously transplanted, weakly antigenic breast carcinoma and subjected to the magnetic field, sufficient temperature rise was obtained to cause significant (~50%) tumor regrowth delay and a 12% permanent control. The data demonstrate that glass-ceramic-mediated hysteresis heating may be a useful therapeutic approach in the treatment of cancer which offers the advantage of producing a highly localized and predictable tumor volume hyperthermia. (24 refs.)

73630 Cell surface effect of 60-Hz electromagnetic fields. M.T.Marron, B.Greenebaum, J.E.Swanson, E.M.Goodman (Biomedical Res. Inst., Univ. of Wisconsin-Parkside, Kenosha, WI, USA).
Radiat. Res. (USA), vol.94, no.1, p.217-20 (April 1983).
Physarum polycephalum amoebae grown in liquid medium and exposed simultaneously to a 60-Hz sinusoidal electric field of 1.0 V/m (rms) and a 60-Hz sinusoidal magnetic field of 0.1 mT (rms) imposed at right angles in phase with the electric field have a smaller partition coefficient in a two-phase aqueous polymer system than control cultures. This observation implies a variation in either cell surface charge or cell surface composition due to field exposure. (25 refs.)

RBE of spleen CFU-S to low dose rate Cf-252 neutron or photon radiation .... See Entry 73644

87.50B Interactions of biosystems with radiations

73631 Light gradients in plant tissue. M.Seyfried, L.Fukshansky (Inst. fur Biologie II, Univ. Freiburg, Freiburg, Germany).
Appl. Opt. (USA), vol.22, no.9, p.1402-8 (1 May 1983).
In this paper the authors suggest a method of calculating light gradients in scattering and absorbing media. The method is based on the Kubelka-Munk theory and involves computational modeling of light fluxes in a multilayered

object, when every layer satisfies the prerequisites of the Kubelka-Munk theory. The model also includes specular reflection that may contribute strongly to internal photon fluence rates for diffuse light. To illustrate the possible effects of light gradients, a cotyledon of Cucurbita pepo is described in terms of this model. It is argued that a number of results in in vivo spectroscopy cannot be correctly interpreted unless light gradients or optics in general are included in the discussion, i.e. the light flux at the site of the pigment has to be known. To outline the difficulties involved some methods of measuring light gradients or internal photon fluence rates are critically considered. (30 refs.)

Possible nature of the fluctuations of the reflective capacity of bilayer lipid membranes excited on electrostriction .... See Entry 73536

The dielectric properties of normal and tumour mouse tissue between 50 MHz and 10 GHz .... See Entry 73552

Is bone a Cosserat solid? .... See Entry 73625

87.50E Bio-optics (effects of microwaves, light, laser and other electromagnetic waves)

73632 **Mechanism of the microwave effect on the conductivity of bilayer lipid membranes.** S.I.Alekseyev, V.V.Chertishchev, Yu.A.Kim (Inst. of Biological Phys., Acad. of Sci., Pushchino, USSR).
Biophysics (GB), vol.27, no.3, p.564-6 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.545-6 (1982).
The ratio of the change in conductivity, compared to its original value, against the specific absorbed power of the high-frequency electromagnetic field used has been measured and analysed. The dependence of the change in conductivity on specific absorbed power was linear. The results indicate the local thermal nature of the action of high-frequency electromagnetic fields on bilayer lipid membranes. (7 refs.)

73633 **Non-thermal effect of UHF pulses of nanosecond duration on the transepithelial transfer of sodium ions.** N.D.Devyatkov, Z.S.Chernov, O.V.Betskii, T.A.Novskova, A.V.Butvinskii (Inst. of Radioengng. & Electronics, Acad. of Sci., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.572-4 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.552-3 (1982).
Proposes a new approach to study of the non-thermal effects of the interaction of radiation with matter based on the use of u.h.f. radiation in the form of short pulses of nanosecond duration the peak power of which reaches tens and hundreds of MW. General heating of the irradiated specimen practically does not occur. To verify this possibility a relativistic u.h.f. nanosecond generator of the reciprocal wave tube type was developed based on an electron accelerator with a cathode working in the regime of explosive emission. The main parameters of the generator are described. Experiments on frog skin are described. (5 refs.)

73634 **Effect of laser radiation on the synthesis of lipids in yeasts.** L.P.Koval'chuk, S.A.Burtseva, P.N.Razumovskii (Dept. of Microbiology, Acad. of Sci., Kishinev, USSR).
Biophysics (GB), vol.27, no.3, p.574-5 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.554-5 (1982).
Reports experiments showing the active influence of laser rays in changing the biosynthesis of total lipids and their fractions in Rh. gracilis k-1 yeasts. (2 refs.)

87.50G Ionizing radiations (u.v., X-ray, gamma-ray; particle radiation effects)

73635 **Radiation physics, dosimetry, chemistry and biology. IV. To the physical frame of the microscopic radiobiological action.** J.Bednar (Inst. of Nuclear Res., Czechoslovakia).
Jad. Energ. (Czechoslovakia), vol.29, no.4, p.126-8 (April 1983).
For pt.III see ibid., vol.28, no.1, p.8 (1982). The physical frame of primary action of ionizing particles is shown in terms of quantum dynamics while that of the radiobiological action in terms of stochastics. A cursory attempt to associate some physical notions with the radiobiological notions of target, hit, etc., is made. (8 refs.)

73636 **Radiation biology: the conceptual and practical impact on radiation therapy.** H.D.Suit (Dept. of Radiation Medicine, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA).
Radiat. Res. (USA), vol.94, no.1, p.10-40 (April 1983).
Radiation biology has had an important impact on clinical radiation therapy by providing a rationale for implementation of new treatment strategies and for clinical concepts or practices thereby increasing their acceptance. The observed rather narrow range of D_0 and n values for mammalian cells contributed to successful trials of radiation treatment of several 'radiation-resistant' tumors, e.g. carcinoma of prostate, color-rectum, and sarcoma of soft tissue. Attention of clinicians was forcibly directed to assessment of local results (local failure, treatment complications) and not merely survival at 5 years by the extensive literature of cell survival curves (in vivo and in vitro) and dose-response assays on normal and tumor tissues. Upon these same laboratory results a scientific rationale was developed for use of shrinking field technique, low dose for subclinical disease, and the combination of moderate dose radiation therapy and conservative surgery. The entire area of clinical research into altered dose fractionation schedules is based upon research on cell proliferation kinetics and repair of radiation damage. The understanding that the time for complete regression of tumor depends not only upon cell kill but also on the pattern of cell proliferation of the progeny of lethally irradiated cells and the abundance of stroma provided a basis for accepting patients with slowly responding tumors for treatment. There remains a wide field of need in research in this area as even today a large proportion of patients who die of cancer die with their cancer uncontrolled at the primary stage. (112 refs.)

73637 **The oxygen enhancement ratio for single- and double-strand breaks induced by tritium incorporated in DNA of cultured human T1 cells. Impact of the transmutation effect.** G.Tisljar-Lentulis (Inst. of Medicine, Nuclear Res. Center Julich GmbH, Julich, Germany), P.Henneberg, L.E.Feinendegen.
Radiat. Res. (USA), vol.94, no.1, p.41-50 (April 1983).
The effect of oxygen, expressed as the oxygen enhancement ratio (OER), on the number of single-strand breaks (SSB) and double-strand breaks (DSB) induced in DNA by the radioactive decay of tritium was measured in human T1 cells whose DNA had been labeled with tritium at carbon atom number 6 of thymidine. Decays were accumulated in vivo under aerobic conditions at 0-1°C and at −196°C and in a nitrogen atmosphere at 0-1°C. The number of SSB and DSB produced was analyzed by sucrose gradient centrifugation. For each tritium decay there were 0.25 DSB in cells exposed to air at 0-1°C and 0.07 in cells kept under nitrogen, indicating an OER of 3.6, a value expected for such low-LET radiation. However, for each tritium decay there were 1.25 SSB in cells exposed to air at 0-1°C and 0.76 in cells kept under nitrogen indicating an OER of only 1.7. The corresponding values for ^{60}Co γ radiation, expressed as SSB per 100 eV absorbed energy, were 4.5 and 1.0, giving an OER of 4.5. The low OER value found for SSB induced by tritium decay can be explained if 31% of the total SSB produced in air result from transmutation by a mechanism which does not produce DSB and is unaffected by oxygen. (35 refs.)

73638 **X-irradiation effect on human red cells: hemoglobin study by Mossbauer spectrometry.** A.Chevalier, C.Kellershohn, J.N.Rimbert (Lab. de Biophys., Faculte de Medecine Necker-Enfants Malades, Paris, France).
Radiat. Res. (USA), vol.94, no.1, p.51-65 (April 1983).
Reports a study of the radioinduced transformations undergone by intraglobular hemoglobin. Mossbauer spectrometry allows one to study in a wide range of doses the effect of X-rays on deoxyhemoglobin as well as on oxyhemoglobin. Using this technique the authors have shown large differences between these two derivatives of hemoglobin. Deoxyhemoglobin leads to the formation of only one ferric nonheme compound while oxyhemoglobin produces this same compound as a last step after intermediary production of deoxyhemoglobin, methemoglobin, hemichromes, and hemochromes. The authors have also found that heat incubation and X-rays have a similar effect on HbO_2 except for the dissociation, which is absent in heat incubation. The authors have found a value for the energy needed for such a radiodissociation of HbO_2 similar to that given by other authors utilizing other methods. Finally, some explanations are proposed for the formation of the different compounds involved based on structure considerations. (28 refs.)

73639 **Inhalation carcinogenesis of high-fired $^{241}AmO_2$ in rats.** C.L.Sanders, J.A.Mahaffey (Biology Dept., Pacific Northwest Lab., Richland, WA, USA).
Radiat. Res. (USA), vol.94, no.1, p.66-80 (April 1983).
Wistar rats were given a single inhalation exposure to high-fired $^{241}AmO_2$ particles and examined over their life span. A total of 310 rats were used: 259 exposed to ^{241}Am for life-span study, 30 exposed to ^{241}Am for early metabolism study, and 21 unexposed life-span controls. The activity median aerodynamic diameter of the aerosols was 0.75-1.39 μm. About 55% of alveolarly deposited ^{241}Am was cleared from the lung with a half-life of 0.5 days, 37% with a half-life of 7 days, and 8% with a half-life of 580 days. Group mean lung doses ranged from $<$5.7 rad up to 1500 rad. Significant early mortality due to radiation pneumonitis was seen only in the highest exposure group. The percentage of rats with lung tumors was 0% for controls (21 rats), 1% at lifetime lung doses $<$10 rad (139 rats), 7% at 10-50 rad (86 rats), 0% at 50-100 rad (9 rats), 60% at 100-500 rad (10 rats), and 7% at 500 rad (15 rats). Only one liver and one bone tumor were found in all exposed rats, both at lifetime tissue doses $<$10 rad. The fate and carcinogenicity of inhaled $^{241}AmO_2$ in the lung of rats were similar to what has previously been described for inhaled $^{244}CmO_2$. (31 refs.)

73640 **Dose-rate effects in mammalian cells. IV. Repairable and nonrepairable damage in noncycling C3H $10T^{1}/_{2}$ cells.** R.L.Wells, J.S.Bedford (Dept. of Radiology & Radiation Biology, Colorado State Univ., Fort Collins, CO, USA).
Radiat. Res. (USA), vol.94, no.1, p.105-34 (April 1983).
Repairable and nonrepairable components of γ-ray damage leading to cell reproductive death were determined by measuring the range over which dose rate influenced the response of noncycling C3H $10T^{1}/_{2}$ mouse cells. Cell proliferation and cell cycle redistribution were eliminated as factors influencing the dose-rate effect in the system by irradiating confluent monolayers of contact inhibited cells. The radiosensitivity of the cells did not change, and no selective loss of damaged cells occurred over the extended treatment times. A pronounced dose-rate effect was observed over the range between 55.6 and 0.29 Gy/hr, but a limit to the repair-dependent dose-rate effect was reached at 0.29 Gy/hr since no further reduction in effect per unit dose was observed when the dose rate was reduced to 0.17 or 0.06 Gy/hr. The survival curves, which were simple exponential functions of dose at dose rates of 0.29 Gy/hr and below, have a common D_0 of 7.32 Gy and represent an accurate measurement of the nonrepairable component of damage. Log-phase cultures showed remarkably different responses over the range of dose rates, due in large part to cell cycle redistribution and in some cases, cell proliferation during exposures. (69 refs.)

73641 **Effects of ^{60}Co radiation on synthesis of prostaglandins $F_{2\alpha}$, E, and thromboxane B_2 in lung airways of guinea pigs.** L.K.Steel, I.K.Sweedler, G.N.Catravas (Biochem. Dept., Armed Forces Radiobiology Res. Inst., Bethesda, MD, USA).
Radiat. Res. (USA), vol.94, no.1, p.156-65 (April 1983).
At 1 hr to 14 days after total-body exposure of guinea pigs to 3.0 Gy ^{60}Co, changes were detected in prostaglandin concentrations in bronchial airway tissues. At 3 hr postexposure, tissue levels of PGE were significantly elevated, while at 48 hr transiently elevated levels of $PGF_{2\alpha}$ were observed. By 72 hr, levels returned to control values. Airway synthesis of thromboxane B_2 in irradiated animals did not differ from that in controls. Also assessed were the capacities of bronchial airway preparations to respond to H-1 receptor stimulation by the exogenous addition of histamine or transmembrane divalent cation transport stimulation with ionophore. Tissues from irradiated animals demonstrated alterations in the amount and type of prostaglandins generated, varying with time postirradiation. (42 refs.)

73642 **Response of mouse small intestine to fractionated doses of pions.** K.R.Rao, H.Fritz-Niggli (Strahlenbiologisches Inst., Univ. Zurich, Zurich, Switzerland).
Radiat. & Environ. Biophys. (Germany), vol.21, no.4, p.247-54 (1983).
The effect of single or fractionated doses of stopping pions or 200 kV X-rays on the mouse jejunal crypt cells was used to determine in vivo RBE values. For single fraction, the pion/X-ray RBE was 1.27 and it increased to about 1.31 when two fractions were applied at 3 or 24 h interval. When four fractions were given at 3 h intervals, the RBE was 1.46. This is because the fraction of 'dose repaired' was always higher for X-rays than for pions and this difference was enhanced when more dose fractions were used. The data presented are, in general, consistent with the biological effects of pions reported for other in vivo end points. (22 refs.)

73643 **Increased radioresistance of cells in cultured multicell spheroids. II. Kinetic and cytogenetic studies.** G.Hinz, H.Dertinger (Inst. fur Genetik und fur Toxikologie von Spaltstoffen, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
Radiat. & Environ. Biophys. (Germany), vol.21, no.4, p.255-64 (1983).
For pt.I see ibid., vol.19, p.101-7, 1981. Using the Chinese hamster cell line B14 FAF28, several specific properties of the contact effect (CE) of radiation action in spheroids were investigated. CE was found to 'protect' the spheroid cells against several types of radiation-induced cytogenetic misfunctions such as blockage in S and G_2+M-phase, mutagenesis, and chromosome damage. However, repair of DNA strand-breaks was the same in monolayers and spheroids. Furthermore, CE is a property of the single cell and does not

depend on the proliferative status (cycling or non-cycling) of the cells. It is concluded that CE is the result of a physiological modification of the cells occurring during growth in the three-dimensional spheroid matrix and requiring metabolic cooperation and cyclic AMP for its induction. (23 refs.)

73644 RBE of spleen CFU-S to low dose rate Cf-252 neutron or photon radiation. Y.Maruyama, J.M.Feola, H.N.Hwang, A.Williams, J.L.Beach (Radiation Therapy Oncology Center, Univ. of Kentucky Medical Center, Lexington, KY, USA).
Radiat. & Environ. Biophys. (Germany), vol.21, no.4, p.265-74 (1983).
The RBE of Cf-252 neutron irradiation was determined for hemopoietic tissue using spleen CFU-S. Radiosensitivity was compared to acute Cobalt-60 radiation and low dose rate Cesium-137 under identical irradiation conditions. The RBE for the neutron component of the Cf-252 radiation was 2.1. No dose rate effect was observed for hemopoietic CFU-S to acute doses or low dose rate photon irradiation. (25 refs.)

73645 Accumulation and lethal effect of tritium (tritiated water) in Rhodopseudomonas spheroides under light-anaerobic and dark-aerobic conditions. T.Inomata (Dept. of Radiation Res., Tohoku Univ. School of Medicine, Sendai, Japan).
Radiat. & Environ. Biophys. (Germany), vol.21, no.4, p.281-94 (1983).
The distribution of exchangeable ^{3}H in cold acid-soluble and ether-ethanol-soluble fractions and nonexchangeable ^{3}H bound to small molecules and macromolecules was 7.4/25.3/67.3 in growing cells cultured anaerobically in THO-medium up to the late exponential phase in the light. The distribution in nongrowing cells incubated anaerobically with the THO-medium for 18 h in light of 300 and 3000 lux was 82.1/8.4/9.5 and 58.2/19.2/22.6, respectively. These distributions of ^{3}H were changed with growth phase and/or incubation time. On the biological effect of ^{3}H-THO on cells stocked at −196°C to accumulate ^{3}H-decays, dark-aerobic nongrowing cells labelled with THO were rather more radiosensitive than dark-aerobically and light-anaerobically grown cells cultured in the THO-medium. The killing efficiencies, i.e. the probability that a single disintegration would be lethal, ranged from $^1/_{200}$ to $^1/_{275}$ for the above three kinds of cells labelled with THO. The killing efficiencies for *R.* spheroides labelled with THO were similar to that for the radiosensitive strain CB13 and the wild strain Hfr of Escherichiacoli labelled with ^{3}H-thymidine and stored at −196°C. (23 refs.)

73646 Evidence for radiation-induced bulky lesions in DNA. H.Martin-Bertram, E.Rumpf, C.Winkler (Inst. fur Biologie, Gesellschaft fur Strahlen- und Umweltforschung, Neuherberg/Munchen, Germany).
Radiat. & Environ. Biophys. (Germany), vol.21, no.4, p.305-7 (1983).
To dissect the contribution of modified bases on the deformation of the DNA structure, independently from a specific base lesion, the authors probed the existence of bulky lesions after UV-irradiation of λ-DNA and after γ-irradiation of bacteriophage λ. (6 refs.)

Measurements of the annual variation of the erythema dose of global radiation ....See Entry 73668

87.60 MEDICAL AND BIOMEDICAL USES OF FIELDS, RADIATIONS, AND RADIOACTIVITY

(see also 28.80 Nuclear radiation technology, including shielding)

87.60B Sonic and ultrasonic radiation

73647 Discrete time estimation of the mean Doppler frequency in ultrasonic blood velocity measurements. B.A.J.Angelsen, K.Kristoffersen (Div. of Engng. Cybernetics, Univ. of Trondheim, Trondheim, Norway).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.207-14 (April 1983).
A new Doppler frequency estimator operating in the discrete time domain is derived from an analysis of the Doppler signal statistics. It is shown that the estimator gives a nearly unbiased estimate of the mean frequency of the signal spectrum, regardless of the spectrum shape. The discrete time implementation gives the advantage that, under specified conditions, the range-velocity product of a pulsed Doppler velocity meter can be increased. (10 refs.)

73648 Theoretical framework for spectrum analysis in ultrasonic tissue characterization. F.L.Lizzi, M.Greenebaum, E.J.Feleppa, M.Elbaum (Riverside Res. Inst., New York, NY, USA), D.J.Coleman.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1366-73 (April 1983).
An analytic model is described for application in ultrasonic tissue characterization. The model is applicable to clinical broadband pulse echo systems. It treats spectra derived from received echo signals and related them to physical tissue properties. The model can be applied to deterministic tissue structures (e.g., retinal detachments, larger blood vessels, and surface layers of the kidney) and to stochastic tissue structures (e.g., various tumors). The beam patterns included in the model are those generated by focused transducers typically used in high-resolution clinical ultrasound. Appropriate calibration procedures are also treated: these are needed for interpretation of absolute spectral parameters. The results obtained with the analytic model have been used to design a digital processing system and the associated techniques which are now being applied during examinations of the eye and abdominal organs. The results have proven useful in interpreting data from various types of tissues. To illustrate the application of these results, representative clinical data, obtained from the digital system, are presented for two types of tissue architectures. The first case is a detached retina representing a deterministic structure characterized by well-defined thickness and reflection coefficients. The second case is asteroid hyalosis and represents a stochastic entity in which the positions of small scattering particles are best described in statistical terms, and characterization is accomplished by means of normalized power spectra. (15 refs.)

73649 Ultrasonic diffraction tomography using higher-order solution of perturbation. A.Kawanaka, K.Nakayama (Faculty of Sci. & Technol., Sophia Univ., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part D (Japan), vol.J66D, no.2, p.190-7 (Feb. 1983). In Japanese.
The ultrasonic diffraction tomography which reconstructs the ultrasound velocity distribution of an object based on the 1st-order solution of perturbation of the wave equation has already been reported. The authors introduce complex refractive index in order to deal with dissipative media. Moreover, by means of representing its distribution using higher-order terms of perturbation, they derive a new method that reconstructs complex refractive index distribution taking into account of the higher-order solution of perturbation. The computer simulation result on a dissipative object is presented that indicates the consideration of the 2nd-order solution of perturbation and improves the reconstructed image comparing with the 1st-order solution of perturbation. (10 refs.)

Microcomputer-controlled psychoacoustics in clinical audiology ....See Entry 73681

87.60D Electric and magnetic fields (d.c. and pulsed)

Glass-ceramic-mediated, magnetic-field-induced localized hyperthermia: response of a murine mammary carcinoma ....See Entry 73629

Optimization and design of permanent magnet devices for retaining dental prosthetic appliances ....See Entry 73685

87.60G Laser beams, microwaves, and other electromagnetic waves

(inc. NMR; for X-rays and gamma-rays, see 87.60J)

73650 Optimal field for detection of magnetically labeled blood. J.H.Battocletti, R.E.Halbach (Dept. of Neurosurgery, Medical Coll. of Wisconsin, Milwaukee, WI, USA).
J. Magn. Resonance (USA), vol.52, no.3, p.500-4 (May 1983).
The authors comment on a recently published paper by Pochobradsky (see ibid., vol.48, p.63 (1983)) on the optimization of the tag-detect technique of blood flow measurement using proton nuclear magnetic resonance. The important consideration in implementing the tagging technique in a usable NMR flowmeter is signal-to-noise ratio. Therefore, the absolute change in magnetization (ΔM) is most important. Second, and reinforcing this conclusion, the change in voltage generated by ΔM is usually amplified in an AC amplifier which removes the steady-state component of M. This becomes even more important when magnetization of stationary tissue occurs, and the steady-state component of M must be removed so as not to saturate the low-frequency amplifiers. (6 refs.)

73651 A microcomputer-based multithermocouple system for use in microwave fields. P.R.Horseman, D.J.Law, P.B.Dunscombe, K.Gammampila, B.M.Southcott (Dept. of Medical Phys., Charing Cross Hospital, London, England).
J. Med. Eng. & Technol. (GB), vol.7, no.2, p.96-100 (March-April 1983).
A PET-controlled multithermocouple system employing Analog Devices 4 channel amplifiers has been constructed. The intended application of the equipment is the measurement of the temperature distribution in patients receiving microwave hyperthermia as part of cancer therapy. The equipment has been shown to be sufficiently accurate and, in addition, is not susceptible to RF interference at the power levels in use in the authors' hospital for microwave hyperthermia. (8 refs.)

73652 Medical imagery. D.B.Isabelle, A.Veyre (Lab. of Corpuscular Phys., Univ. of Clermont-Ferrand II, Clermont-Ferrand, France).
Recherche (France), vol.14, no.144, p.690-2, 695-8, 701-6 (May 1983). In French.
Until the last twenty years the doctor who wished to explore the body of his patient had only X-rays and radiography. The latter remains irreplaceable. A new technique is being developed—that of nuclear magnetic resonance and the paper deals with this. The developments in X-ray techniques are first described, including the application to them of computer science. Then follows a description of the development of nuclear magnetic resonance techniques. The key to radiography is the possibility of obtaining better contrast in the images. The use of radioactive material introduced into the body is described, from its early days, including its use to give numerical details of dynamic performance. Work is now towards a space representation of the organ examined. Tomography by emission is described, as are temperature charts. (9 refs.) *G.V.D.*

73653 Therapeutic applications of electromagnetic heating. L.S.Taylor (Dept. of Electrical Engng. & Radiation Oncology, Univ. of Maryland, College Park, MD, USA).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.425-31 part 1
A review of the general history of the medical applications of radio-frequency and microwave fields is followed by a discussion of the particular use of microwave fields to produce hyperthermia for cancer therapy, and to produce coagulation in surgery. A possible new class of electromagnetic applicators suitable for deep-lying tumors, and a new electrosurgical tool are described. The question of radiation safety is discussed both in the context of therapeutic applications and in relation to the effects of low level fields. (14 refs.)

73654 Design of microwave hyperthermia applicators for optimum power transfer. R.H.Johnson, J.R.James (Royal Military Coll. of Sci., Shrivenham, England).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.485-9 part 1
Demonstrates by computations using plane wave methods the significance of the impedance match between the applicator and various combinations of body tissue layers. The authors then describe simple low-profile applicators having a resonant radiator embedded in low loss high permittivity material ($\epsilon'=30$). By introducing material having significant permeability as well as high permittivity it is shown that the operating frequency can be reduced for a given applicator size while permitting a good power transfer. The resolution or area that can be heated is a direct function of applicator size. (8 refs.)

73655 Optical fiber thermometer for medical use. A.M.Scheggi, M.Brenci, G.Conforti, R.Falciai, G.P.Preti.
First International Conference on Optical Fibre Sensors, London, England, 26-28 April 1983 (London, England: IEE 1983), p.13-16
Describes a new temperature sensor utilizing attenuation of the light transmitted along a multimode fiber, induced by a temperature sensitive clad applied on a terminal portion of the fiber. The temperature sensor proposed utilizes a silica plastic fiber with an unclad terminal portion and a reflecting end face, immersed in a liquid having a refractive index equal or higher than that of the silica core. Different mineral oils or mixtures have been used as temperature sensitive liquids and correspondingly different intervals in a large range of temperature can be covered so to utilize the thermometer for various applications such as electrical equipment monitoring, r.f. or microwave heating techniques for industrial applications. The reduced probe dimensions and the sensitivity already obtained make this sensor promising for medical use, in particular for localized temperature control in hyperthermia treatment. (8 refs.)

87.60J Corpuscular radiation and radioisotopes

(inc. X-rays and gamma-rays)

73656 Repositioning errors in measurement of vertebral attenuation values by computed tomography. E.Breatnach, P.J.Robinson (Diagnostic Imaging Unit, St. James's Hospital, Leeds, England).
Br. J. Radiol. (GB), vol.56, no.665, p.299-305 (May 1983).
Difficulty in repositioning makes a major contribution to reproducibility errors in measurements of bone mineral by computed tomography (CT). The magnitude of measurement variations arising from incremental movements in each of three directions of displacement and two directions of rotation were investigated using two sections of cadaver spines each including three vertebral bodies. Within the range of variation in position readily attainable by currently available scan plane selection techniques, changes in measured attenuation were small. Estimated variations resulting from compounded errors of different movements averaged 8.3 Hounsfield units for a single vertebra and 4.9 Hounsfield units for three adjacent vertebrae. The largest change in measured attenuation which could be attributed with 95% confidence to repositioning error within the quoted limits of scan plane selection was estimated to be approximately 15 HU for a single vertebra and 8HU for three adjacent vertebrae. (9 refs.)

73657 Electron contamination of large cobalt 60 photon beams. J.F.Sutcliffe (Phys. Dept., Royal Devon & Exeter Hospital, Exeter, England), G.S.Innes.
Br. J. Radiol. (GB), vol.56, no.665, p.321-8 (May 1983).
Experimental results are presented of the electron contamination of cobalt 60 gamma photon beams from the Mobaltron MS80, over a range of SSDs from 60 cm to 3.5 m. In the absence of an electron filter, the skin dose can exceed the dose at 4 mm depth by up to 1.6 times due to the high level of electron emission from the depleted uranium collimators. 4mm of perspex effectively removes these electrons, and in the filtered beam, the skin dose cannot exceed the 4 mm dose. The electron contamination of a 6 MV X-ray beam is compared. (10 refs.)

73658 An accurate and automatic positioning system for penumbra wedges applicable to the radiotherapy of Hodgkin's disease. R.J.de Vos (Radiotherapy Inst., Limburg, Netherlands).
Br. J. Radiol. (GB), vol.56, no.665, p.339-40 (May 1983).
The steep cross-sectional dose gradient at the field edges of linear accelerators strongly affects the junction of extended fields as used in the irradiation of Hodgkin's disease. This problem is alleviated by flattening the dose gradient at the junction edge, where the field covers the spinal cord, by means of a so-called penumbra wedge. A description is given of a system which adjusts the position of the penumbra wedge as a function of the chosen field size. The system has been designed to simplify handling for the radiographers and to optimise reliability. (2 refs.)

73659 Gamma camera MTF measurements using an image chain analysis approach. G.Q.Maguire,Jr., M.E.Noz, J.H.Schimpf, S.C.Horii (Dept. of Radiology, New York Univ., New York, NY, USA).
Comput. & Biomed. Res. (USA), vol.16, no.2, p.149-59 (April 1983).
Image chain analysis is applied to the determination of the modulation transfer function (MTF) for a gamma camera. A simple method for performing this measurement for the purposes of quality control and acceptance testing is given. The parameters necessary for performance of this measurement are discussed. The computer program used is available in both FORTRAN VI and BASIC. (15 refs.)

73660 Estimation of mean transit times from semiquantitative indices derived from standard renograms. J.H.Amuasi, J.C.W.Crawley, N.Veall (Radioisotopes Div., MRC Clinical Res. Centre, Harrow, England), H.A.Wilkins, A.G.Cronquist.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.211-16 (May 1983).
Statistical analysis has been used to find the best relationship between mean transit time calculated from corrected (blood-background subtracted) renograms and empirical indices measured directly from the standard renogram. The best formula of those compared for estimating mean transit time when both time-to-peak and % maximum activity at 15 min are known is $Y=0.17+0.49X_1+0.003X_2$, where Y is a dependent variable and X_1 and X_2 are predictor variables. (7 refs.)

73661 In vivo nitrogen analysis using ^{241}Am-Be neutrons—a feasibility study for a mobile facility. B.W.East (Health Phys. & Nuclear Medicine Unit, Scottish Univs. Res. & Reactor Centre, Glasgow, Scotland).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.217-21 (May 1983).
The possibility of adapting the East Kilbride mobile whole-body counter laboratory for the capture gamma-ray analysis of nitrogen in vivo has been examined. The results of the preliminary work reported are promising. (9 refs.)

73662 A critique of the breath-by-breath radioabsorptiometric assay of stable xenon in expired air [and reply]. V.Dhawan (Cotzias Lab. of Neuro-Oncology, Memorial Sloan-Kettering Cancer Center, New York, NY, USA), J.E.Holden.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.231-2 (May 1983).
A paper by W.R. Ip et al. (ibid., vol.3, p.151-4, 1982) is commented on by Dhawan. Dhawan says that although the computerised tomographic radioabsorptiometric method for monitoring end-tidal Xe concentration is promising, the detector design proposed by Ip et al. is far from ideal and requires considerable modification if radioabsorptiometry is to replace thermoconductivity or mass spectrometric measurements of end-tidal Xe concentration. In reply for Ip et al. Holden refutes the comments of Dhawan maintaining that their measurement precision still stands, that their data were not compressed and implying that their detector design was necessary. (4 refs.)

73663 The future of radioiodines. G.L.DeNardo (Davis Medical Center, Univ. of California, Sacramento, CA, USA).
J. Radioanal. Chem. (Switzerland), vol.76, no.2, p.337-40 (1983).
The author reviews the history of medical uses of radioiodines and describes possible future advances in this field. (7 refs.)

Radiation biology: the conceptual and practical impact on radiation therapy .... See Entry 73636

Medical imagery .... See Entry 73652

The generator production of ^{172}Lu from ^{172}Hf for limited nuclear medicine research .... See Entry 73664

Tissue-air ratios for cobalt 60 therapy units .... See Entry 73665

Exit dose studies in megavoltage photon therapy .... See Entry 73666

87.60L Preparation of radioactive materials for medical and biomedical uses

73664 The generator production of ^{172}Lu from ^{172}Hf for limited nuclear medicine research. P.M.Grant, R.J.Daniels, W.J.Daniels, G.E.Bentley, H.A.O'Brien,Jr. (Medical Radioisotope Res. Group, Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Radioanal. Chem. (Switzerland), vol.76, no.2, p.319-23 (1983).
A solvent extraction system has been developed for the separation of ^{172}Lu from its long-lived ^{172}Hf parent. The parent-daughter pair in equilibrium is maintained in a solution of HDEHP, and the heavy lanthanide daughter is extracted into 9M HCl. The separation factor for this generator is approximately 10^4. The rare-earth activity so obtained is proposed for compound labelling research and animal biodistribution studies in nuclear medicine. (32 refs.)

Optimization of irradiation parameters for ^{67}Ga production from ^{nat}Zn(p,xn) nuclear reactions .... See Entry 70548

87.60M Radiation dosimetry

73665 Tissue-air ratios for cobalt 60 therapy units. S.M.Vatnitskij (Central Sci. Res. Inst. of Roentgenology & Radiology, Min. of Health, Leningrad, USSR), P.K.Aalto, S.J.Rannikko.
Br. J. Radiol. (GB), vol.56, no.665, p.315-19 (May 1983).
Tissue-air ratio (TAR) is the widely used dosimetric parameter for treatment planning in radiation therapy. Comparison of the measured TAR values of 19 ^{60}Co therapy units of eight different types was made with the widely used tabulated data of Gupta and Cunningham (1966). The experimental data, and the analysis of the variation in the TAR values caused by individual, unit by unit features, show that discrepancies may be up to ±4%. (22 refs.)

73666 Exit dose studies in megavoltage photon therapy. G.D.Lambert, W.E.Liversage, A.M.Hirst, D.Doughty (Dept. of Radiation Phys., St. Bartholomew's Hospital, London, England).
Br. J. Radiol. (GB), vol.56, no.665, p.329-34 (May 1983).
A coin-shaped ionisation chamber, orientated with its thin window facing away from the radiation source, was used to investigate the dose perturbations caused by the absence of back-scattering material near the exit surface of solid phantoms. Cobalt 60 and 4, 8 and 16 MV X-ray beams were used in the study. With no scattering material beyond the chamber window the ionisation was found to be as much as 17% less than the full scatter value. This was attributed to the absence of both back-scattered electrons and back-scattered photons. Full electron back-scattering could be restored by placing between 1.0 and 2.7 mm of unit density material beyond the chamber, depending on the primary beam energy. Under these circumstances the reduction in dose, now due to the absence of back-scattered photons only, was found to be small. (12 refs.)

73667 Preparation and applications of $Li_2B_4O_7$(Cu)TLD. N.Soramasu, Y.Yasuno (Electric Equipment Div., Matsushita Industrial Equipment Co. Ltd., Osaka, Japan), M.Takenaga.
Natl. Tech. Rep. (Japan), vol.29, no.1, p.170-5 (Feb. 1983). In Japanese.
A newly developed phosphor $Li_2B_4O_7$(Cu) with an atomic number of 7.3 is very similar to that of tissue. Phosphor prepared by a sintering method shows to glow peaks composed of a main peak at 205°C and a shoulder at 120°C. The material based on the stoichiometric compound of $Li_2O.2B_2O_3$ has a good moisture resistance property. The dosimetric characteristics are the sensitivity to gamma rays is about 20 times higher than that of $Li_2B_4O_7$(Mn) prepared by the melting method; the main peak of 205°C fades less than 9% in intensity at 25°C after 60 days in darkness. An evaluation method of an absorbed dose and neutron dose are also studied by using a composite TLD 'TL badge' applying the $Li_2B_4O_7$(Cu) phosphor. (7 refs.)

73668 Measurements of the annual variation of the erythema dose of global radiation. W.Ambach, W.Rehwald (Inst. fur Medizinische Phys., Univ. Innsbruck, Innsbruck, Austria).
Radiat. & Environ. Biophys. (Germany), vol.21, no.4, p.295-303 (1983).
The share of erythema dose of global radiation (D_{er}/G) shows significant diurnal and annual variations. This is the result of the dependence of the ratio D_{er}/G on optical air mass. Maximum values of D_{er}/G are found at times of low optical air mass, i.e. at noon and in summer, minimum values at sunrise and sunset hours as well as in winter. Another reason for the annual variation of the ratio D_{er}/G is the changing amount of total atmospheric ozone. Therefore values of D_{er}/G in fall are about 50% higher than in spring despite the same solar declination. Comparing measurements of erythema dose at two stations with different altitudes, a difference of 14% per 1000 m is obtained. (14 refs.)

73669 Radiation Protection. Eighth Symposium on Microdosimetry (EUR 8395 EN).
Luxembourg: Comm. European Communities (1982), xix+1221 pp.
Conference held at: Julich, Germany. Date 27 Sept.-1 Oct. 1982. The following topics were dealt with: microscopic description of radiation interactions with matter (including: charged particle track structure; high-energy particle interactions); measurement and interpretation of radiation action (including: radiation mechanisms at molecular and cellular levels; radiation mechanisms of carcinogenesis); employment of microdosimetric principles in radiation dosimetry and protection (including: radiation response of solid state detectors; determination of quality factors). 100 papers were presented.

Dose conversion factors for intakes of selected radionuclides by infants and adults .... See Entry 70731

Electron contamination of large cobalt 60 photon beams .... See Entry 73657

87.60P Radiation protection

(inc. radiation monitoring)

The function of waste immobilization as a barrier against radionuclide release in the frame of an overall risk assessment .... See Entry 70656

Respirable fines produced by impacts of simulated alternative high-level waste materials .... See Entry 70702

Radiation Protection. Eighth Symposium on Microdosimetry (EUR 8395 EN) . ... See Entry 73669

87.60R Radioactive pollution

(see also 86.70 Environmental science)

Radionuclide transport processes in terrestrial ecosystems .... See Entry 73502

87.65 AEROSPACE BIOPHYSICS AND MEDICAL PHYSICS (EFFECTS OF ACCELERATIONS, WEIGHTLESSNESS AND ENVIRONMENT)

(see also 94.80 Aerospace facilities and techniques; space research)

73670 Changes in the loco-regional cerebral blood flow (r.CBF) during a simulation of weightlessness. A.Guell, Ph.Dupui, M.Barrere, G.Fanjaud, A.Bes (Dept. of Neurology, Centre Hospitalier Univ. Rangueil, Toulouse, France).
Acta Astronaut. (GB), vol.9, no.11, p.689-90 (Nov. 1982). [received: March 1983]
Experiments involving prolonged bedrest in the antiorthostatic position are conducted in order to simulate cardio-circulatory modifications observed in weightlessness. Up to now no studies of r.C.B.F. have been carried out in these conditions. Six young, healthy volunteers (average age 23.8) were placed in strict bedrest and in the antiorthostatic position −4° for 7 days. The r.C.B.F. measurements were studied by the ^{133}Xe inhalation method using a 32 detectors system. Studies were made first in basal conditions, then between the 6th and 12th hr, and finally between the 72nd and the 78th hr after the beginning of the experiment. Three of the subjects received 0.450 mg of Clonidine daily during the experiment. In the subjects having taken no Clonidine, the authors observed a constant increase in r.C.B.F. (12, 17 and 16% respectively) in the first 12 hr; at the 72nd hour, all values had returned to basal state. These findings agree with the well known notion of a rapid correction of hemodynamic disturbances observed in the first days of weightlessness. In the subjects treated with Clonidine, the increase of r.C.B.F. did not occur. Several mechanisms of action are possible; the Clonidine affecting either the heart by inhibiting volemic atrial receptors, or the brain by direct vasoconstriction. (12 refs.)

73671 Configuration design of a closed-loop, pseudogravitational, environmental research facility in low Earth orbit. J.B.Jones-Oliveira (Dept. of Astronautics & Aeronautics, MIT, Cambridge, MA, USA).
Space Sol. Power Rev. (GB), vol.3, no.4, p.317-35 (1982).
The object of the study was to design a space habitat from an architectural perspective employing today's space technologies. The primary launch vehicle, the Space Shuttle, the space transportation system (STS) carrying the modular components of the research facility to low Earth orbit (LEO), was an essential and integral technological achievement making the project possible. Therefore, the characteristics of the orbiter, specifically the allowable payload requirements for volume and weight, were major design parameters. In other words, the maximum critical dimensions of all components of the research facility were limited by the allowable volume available for payloads in the cargo bay (approximately a cylinder of 5×18 m); similarly, the maximum allowable payload requirement of 29500 kg (65048 lb) was satisfied. Given these constraints, in conjunction with other engineering problems to be discussed herein, it was the human factor that was then regarded the driving factor throughout the design process. The goal was to demonstrate the near future realizability for human health, safety, and comfort, both physical and psychological, in permanent, manned LEO facilities. The proposed mission of the Satellite Pseudogravitational Operational Research Environment (SPORE) is to accomplish a comparative research investigation examining the trade-offs among various centrifugally induced pseudogravitational forces; the associated rate of rotation, taking in the first mission to be 2 r.p.m.; the health and productivity of the scientists, as well as the biological organisms on which they will be conducting experiments; and the cost of creating the environment. (4 refs.)

87.70 BIOMEDICAL ENGINEERING

73672 A temperature-sensitive respiratory alarm. S.W.Smye, J.M.Frayne, J.Copeland (Dept. of Medical Phys., Barnsley District General Hospital, Barnsley, England), A.J.Wilson.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.223-6 (May 1983).
Describes a novel alarm which is designed to monitor respiration in a patient undergoing intermittent positive pressure ventilation. The alarm operates by sensing the temperature differences between the inspired and expired gas using a thermistor mounted close to the point in the breathing circuit where the patient connection is made. It offers several significant advantages: it is a patient-orientated device as it monitors the respiratory process; it will not register an alarm during endotracheal toilet; and it may be used on spontaneously breathing patients in the presence or absence of a constant distending pressure. Further, the thermistor alarm is unaffected by condensation and, finally, it monitors the humidifier performance (this is additional to any alarm system that may be provided with the humidifier). (no refs.)

73673 Effect of EMG onset variation on average motor potentials. H.P.Greeley (Res. Dept., Veterans Administration Hospital, White River Junction, VT, USA).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.2, p.227-30 (May 1983).
Results are reported which show that although there is a wide range of slope values at the onset of a series of EMGs, there is not serious degeneration of the average motor potential waveforms obtained using the slope dependent threshold voltages of the first half cycle as a trigger signal. This is almost certainly due to the short times involved in reaching these threshold levels as well as to the normal distribution of this error. These results confirm the advantage of setting EMG threshold levels low enough to ensure that averaging begins at the first half cycle of the EMG. (5 refs.)

73674 Automatic classification of electromyographic signals. J.L.Coatrieux (Lab. de Traitement du Signal, Faculte des Sci., Rennes, France), P.Toulouse, B.Rouvrais, R.Le Bars.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.333-41 (March 1983).
The results of the application of classification methods to electromyograph signals of weak contractions in normal and myopathic subjects are described. Methods of pattern recognition allow the selection of representative motor unit action potentials. The analysis is done with ordinal qualitative variables obtained by identification of shape descriptive parameters (amplitude, duration, number of phases, number of extrema). From this analysis, characteristic classes for normality and myopathy appear, which can be used as a diagnostic aid. (14 refs.)

73675 Discriminating somatic evoked potentials using a pairwise procedure. Chan F. Lam (Dept. of Biometry, Medical Univ. of South Carolina, Charleston, SC, USA), M.Cox.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.342-9 (March 1983).
Generally, investigators use only the magnitude spectra of a signal for processing or for discriminant analysis, with the phase information discarded. However, it is not difficult to generate two different time domain signals having identical magnitude spectra in the frequency domain. Thus the phase information should not be neglected. This paper presents the results of a simulation study of a discriminant analysis procedure for paired variables, e.g. magnitude and phase pairs. The procedure is then applied to discriminating somatic evoked potentials from normal and damaged spinal cords with excellent results. (9 refs.)

73676 The polarity histogram in relation to the average evoked potential. M.L.Hyde (Dept. of Otolaryngology, Mount Sinai Hospital, Toronto, Ontario, Canada), D.J.Doyle.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.357-60 (March 1983).
It is shown analytically that the polarity histogram (PH) and the average evoked potential (AEP) are linearly related under certain conditions. The relative merits of the two approaches are compared both analytically and by statistical simulation. In general, the PH is a biased estimator of the evoked potential and is less efficient than the AEP, which is unbiased. The PH is more robust against artifact, but this advantage vanishes when conventional artifact rejection is used. The detection of an EP using the PH is problematic. The polarity histogram offers little advantage over signal averaging under typical clinical recording conditions. (6 refs.)

73677 Pressure-derived flow: a new method. J.K.-J.Li (Dept. of Electrical Engng., Rutgers Univ., Piscataway, NJ, USA).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.244-6 (April 1983).
Pulsatile flow waveforms in the dog femoral artery and abdominal aorta were derived from measurements of pressure before and after a brief vessel occlusion. Derived flows compared favorably with directly measured flows in the abdominal aorta, less so in the femoral artery. Possible sources of deviations are discussed. (19 refs.)

73678 A computer algorithm to calculate P_{50} from a single blood sample. L.E.Ostrander (Center for Biomedical Engng., Rensselaer Polytech. Inst., Troy, NY, USA), W.H.Paloski, P.S.Barie, W.A.Carpenter, J.C.Newell.
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.250-4 (April 1983).
Describes an iterative computer-based algorithm which determines P_{50} while avoiding direct inversion of the relationship between blood oxygen partial pressure and oxyhemoglobin saturation. Blood sample measurements and the value of P_{50} are used, together with carboxyhemoglobin data, as necessary, to calculate blood oxyhemoglobin saturation and oxygen content. (18 refs.)

73679 Evaluation of ECG recorders.
J. Med. Eng. & Technol. (GB), vol.7, no.2, p.69-73 (March-April 1983).
Points to bear in mind before deciding which ECG recorder to buy are discussed. The following ECG recorders are evaluated: the Cambridge VS-550; the Fukuda Denshi FD-13; the Cardisuny 501F; and the Kirby Lester ECG 30. (no refs.)

73680 Evaluation of blood-pressure transducers.
J. Med. Eng. & Technol. (GB), vol.7, no.2, p.74-7 (March-April 1983).
The transducers considered are conventional transducers, 'wrist-watch' transducers and miniature transducers. The topics discussed include: domes (reusable or disposable); method of cleaning; method of excitation; durability; standards; units of blood pressure measurement. (no refs.)

73681 Microcomputer-controlled psychoacoustics in clinical audiology. M.E.Lutman (MRC Inst. of Hearing Res., General Hospital, Nottingham, England).
J. Med. Eng. & Technol. (GB), vol.7, no.2, p.83-7 (March-April 1983).
Describes the design and implementation of a microcomputer-controlled experimental rig for psychoacoustical testing in a clinical setting. Firstly, the role of psychoacoustical tests in clinical audiology is reviewed briefly. Some common test procedures are described. The requirements of the hardware and software are outlined together with their realization. Finally, the performance of the system and its usefulness are noted. (4 refs.)

Ion etching and its applicability in medicine .... See Entry 73241

Brain stem auditory evoked potentials: reduction of evaluation errors .... See Entry 73584

Discrete time estimation of the mean Doppler frequency in ultrasonic blood velocity measurements .... See Entry 73647

Optimal field for detection of magnetically labeled blood .... See Entry 73650

Optical fiber thermometer for medical use .... See Entry 73655

In vivo nitrogen analysis using ^{241}Am-Be neutrons—a feasibility study for a mobile facility .... See Entry 73661

87.70E Diagnostic methods and instrumentation

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

Ultrasonic diffraction tomography using higher-order solution of perturbation .... See Entry 73649

Repositioning errors in measurement of vertebral attenuation values by computed tomography .... See Entry 73656

Gamma camera MTF measurements using an image chain analysis approach .... See Entry 73659

Estimation of mean transit times from semiquantitative indices derived from standard renograms .... See Entry 73660

A critique of the breath-by-breath radioabsorptiometric assay of stable xenon in expired air [and reply] .... See Entry 73662

87.70G Patient care and treatment

Radiation biology: the conceptual and practical impact on radiation therapy .... See Entry 73636

A microcomputer-based multithermocouple system for use in microwave fields .... See Entry 73651

Therapeutic applications of electromagnetic heating .... See Entry 73653

Design of microwave hyperthermia applicators for optimum power transfer .... See Entry 73654

Electron contamination of large cobalt 60 photon beams .... See Entry 73657

An accurate and automatic positioning system for penumbra wedges applicable to the radiotherapy of Hodgkin's disease .... See Entry 73658

Exit dose studies in megavoltage photon therapy .... See Entry 73666

87.70J Prosthetics and other practical applications

73682 Theoretical prediction of the oxygen output for a dialysis membrane with a catalyst, in a flat plate dialyzer. M.Zborowski (Inst. of Biocybernetics & Biomedical Engng., Polish Acad. of Sci., Warsaw, Poland).
Biorheology (GB), vol.20, no.2, p.129-40 (1983).
Mass transfer of a solute of small molecular weight across a hydrophilic membrane is discussed and a simplification of the mass transfer analysis is proposed. It was assumed that the permeability of the boundary layer at the membrane surface depends only on the velocity gradient at that membrane surface. Theoretical results are compared with the values of oxygen output at the dialysis membrane activated with an inorganic catalyst, in the presence of hydrogen peroxide, inside a test chamber of a simple geometry and in the flat plate dialyzer. Test chamber data and the theoretical analysis allow for the prediction of the mass transfer efficiency of the dialyzer. (5 refs.)

73683 Scanning electron microscopy examination of a porous alumina prosthetic heart valve. H.Juden, C.R.Gentle (Dept. of Mech. Engng., Trent Polytech., Nottingham, England), D.Dowson.
Biomaterials (GB), vol.4, no.2, p.139-41 (April 1983).
Scanning electron microscopy has been used to examine the porous alumina body of a novel prosthetic heart valve after experimental implantation in a pig. Characteristic features of this unusual material were observed and the biological surface covering resulting from implantation was identified. (9 refs.)

73684 Prosthetic heart valve replacements. N.H.C.Hwang, Xue Zen Nan (Dept. of Civil Engng., Univ. of Houston, Houston, TX, USA), D.R.Gross.
CRC Crit. Rev. Biomed. Eng. (USA), vol.9, no.2, p.99-132 (1983).
The rapid development in the field of heart valve prostheses in the last two decades is reviewed from a hydrodynamic and hemodynamic point of view. Several types of current prosthetic heart valves perform satisfactorily under the usual clinical conditions are discussed with test data obtained in an in vitro flow loop which closely mimic the physiological pressure and flow waveforms. These data are compared with the currently available in vivo measurements from patients and experimental animals. Comparisons are also made with the published data using other in vitro flow loops. The difference and similarity in the results obtained by the various investigators are discussed in light of their physical and physiological significances. (180 refs.)

73685 Optimization and design of permanent magnet devices for retaining dental prosthetic appliances. Y.Kinouchi, T.Ushita, H.Tsutsui, Y.Yoshida (Tokushima Univ., Tokushima, Japan).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.201-6 (April 1983).
Attraction between a pair of rare earth-cobalt magnets is very useful for retention of dental prosthetic appliances. In these applications, the space available for embedding magnets is very narrow. Therefore, the magnets must have those optimum dimensions which cause the maximum attraction. The optimum dimensions are calculated for a rectangular or disk magnet pair utilizing the axial or radial attraction. In order to maximize the axial attraction of a magnet pair in small separation, the rectangular magnet must be slender and the square or disk magnet must have a size ratio of about 0.4, which is defined as the ratio of thickness to length of edge or diameter of the magnet. In the case of radial attraction, the optimum disk magnet has a little larger size ratio, e.g. about 0.55 in zero separation. Based on these theoretical analyses, the method of designing the optimum magnets with a required attraction is proposed. (17 refs.)

73686 Hydraulic evaluation of heart prosthetic valves (in case of mechanical valve). M.Sano, T.Nagahisa, E.Sasakawa, K.Yokoi, T.Iwa (Kanazawa Univ., Kanazawa, Japan).
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.95-102 (Nov. 1982). In Japanese.
Recently, many artificial internal organs have been used clinically. Heart prosthetic valves are one of them. Their hydraulic performance and durability may not be sufficient and further improvements are required. The hydraulic performance of prosthetic valves is examined in this study. Heart prosthetic valves in practical use are classified into biological values and mechanical values by their materials. Mechanical valve types were tested, namely: disc valve, leaflet valve and ball valve. The pressure gradient, the discharge coefficient and the effective orifice area were obtained by steady flow tests. The flow rate, the maximum pressure gradient and the ratio of the valve-full-open time to the diastolic time were obtained by pulsatile flow tests. Pulsatile tests were performed in a pulse duplicator and the flow through the valve was visualized by the aluminium powder tracer method. (4 refs.)

Some further factors affecting the solubility of silicate cements [for dentistry] ....See Entry 72114

The release of organic species from the glass-ionomer cements [for dentistry] .. ..See Entry 72116

Effect of simulated body environments on crack propagation in alumina ....See Entry 73234

87.80 BIOPHYSICAL INSTRUMENTATION AND TECHNIQUES

73687 Measurement of the size distribution of human blood plasma lipoproteins. A.N.Klimov, G.Ye.Shmelev, V.A.Noskin, I.F.Mamontova, L.G.Petrova-Maslakova, N.S.Parfenova (Konstantinov Inst. of Nuclear Phys., Acad. of Sci., Leningrad, USSR).
Biophysics (GB), vol.27, no.3, p.469-74 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.458-62 (1982).
The possibility of using the method of optical mixing for studying the particle size distribution of lipoproteins (l.p.) is shown. The method is found to be sensitive for detecting changes in these distributions on incubation of lipoprotein particles in different conditions. It is shown, in particular, that on incubation of low density lipoproteins (l.d.l.p.) with erythrocytes the donor properties of the l.d.l.p. become manifest in relation to cholesterol while on incubation of high density lipoproteins (h.d.l.p.) with these cells a more complex pattern is observed. The h.d.l.p. isolated from the hypercholesterinaemic plasma exhibit donor and those isolated from the plasma with a normal CS level acceptor properties. In both cases a high degree of aggregability for the total fraction of h.d.l.p. is observed. (7 refs.)

73688 Dynamic structures and non-linear spectral transformations based on the reactions of structural interaction. A.A.Kal'nin (Ul'yanov Electric Engng. Inst., Leningrad, USSR).
Biophysics (GB), vol.27, no.3, p.524-30 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.509-14 (1982).
Outlines the principles of a structural-holographic method of processing biological signals. The method is based on excitation in a dissipative ordered medium of a distributed dynamic set of processes adequate to the external agent and the transformatory properties of associative structural reactions. (8 refs.)

73689 Determination of the size of blood lipoproteins by optical methods. S.M.Burkitbayev, G.Ye.Dobretsov, E.A.Manykin (Engng. Phys. Inst., Second Pirogov State Medical Inst., Moscow, USSR).
Biophysics (GB), vol.27, no.3, p.544-6 (1982). Translation of: *Biofizika (USSR)*, vol.27, no.3, p.528-9 (1982).
Describes an investigation into human blood low density lipoproteins. Two optical methods were combined; fluorescent probes and optical mixing spectroscopy. It is concluded that the combination of these methods makes it possible to rapidly and simply evaluate the heterogeneity of these lipoproteins by size. (8 refs.)

73690 Erythrocyte filtrability measurement by the initial flow rate method. M.Hanss (Lab. de Biophys., Univ. Paris Nord, Bobigny, France).
Biorheology (GB), vol.20, no.2, p.199-211 (1983).
A new filtration technique, based on the initial filtration rate of a diluted RBC suspension through a 5 μ Nuclepore filter, is described. As only a few hundred RBCs traverse each pore and as the measurements are made in a few seconds, the method is largely insensitive to filter plugging and to sedimentation effects. The results are given as a filtration index IF which is, as a first order approximation, independent of the filter conductance and of the suspending medium viscosity. The filtration times are measured electronically. The filters are re-used many times. The influence on the results reproducibility of RBC washing, of the anticoagulant, of the blood sample and the suspension storage times are considered. With the author's technical procedure, the relative incertitude in the measurement of IF is about ±10%. The filtration index is shown to be an intrinsic RBC filterability property. (33 refs.)

73691 Determination of myosin light chain phosphorylation using astronomical image analysis programs on autoradiographs of electrophoretic gels. R.D.Bremel, E.O.Owens, G.M.Olins, C.M.Anderson (Univ. of Wisconsin, Madison, WI, USA).
Comput. & Biomed. Res. (USA), vol.16, no.2, p.127-35 (April 1983).
Computer image analysis programs developed by astronomers for celestial photometry were used for the analysis of autoradiographs of electrophoretic slab gels. Oxytocin-stimulated myosin light chain phosphorylation in mammary myoepithelial cells was studied by incubating cells with $[^{32}P]$orthophosphate followed by oxytocin addition, polyacrylamide gel electrophoresis of cellular protein, and autoradiography of electrophoretic slab gels. After scanning and digitization of autoradiographs, $[^{32}P]$phosphate incorporation into the myosin light chain was measured by the determination of radiation flux recorded on the X-ray film. Within seconds after oxytocin addition, the myosin light chain was fully phosphorylated. The large library of astronomical computer programs has applications for the quantitative analysis of both one- and two-dimensional electrophoretic gels. (11 refs.)

73692 Visual evoked potentials to light flash in cats: is a frontal sinus reference electrode truly indifferent?. P.M.Saxton, J.Siegel (School of Life & Health Sci., Univ. of Delaware, Newark, DE, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.350-4 (March 1983).
In flaxedilized cats, visual cortex evoked potentials (VEPs) to an intensity series of brief light flashes were recorded differentially using either a screw over frontal sinus or an insect pin in neck muscle as the reference electrode. At the same time EPs from the cornea (the ERG) and frontal sinus were recorded differentially against the neck muscle electrode. The EP recorded from the frontal sinus screw was a miniature of the ERG recorded from the cornea, with the same latencies and shape as the ERG but only 10-30% of its amplitude. At a fast presentation rate (1/sec) the amplitude of the ERG, and consequently the frontal sinus potential, decreased with increasing intensity of light flash, whereas at a slow presentation rate (1/3 or 1/5 sec) the ERG and frontal sinus potential increased in response to all but the highest intensities. The effects of the location of the reference electrode and the rate of light flash presentation on visual cortex EP amplitudes are described. (6 refs.)

73693 A simple noise clipping circuit for neurophysiological audio monitors. J.Millar, T.G.Barnett (Dept. of Physiology, London Hospital Medical Coll., London, England).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.55, no.3, p.355-6 (March 1983).
A very simple circuit is described which removes the low amplitude components of audio frequency signals, leaving the positive and negative peaks superimposed on a flat baseline. The clipping is symmetrical and adjustable in gain. Thus the baseline noise in audio monitors used in extracellular single-unit recording can be attenuated. This enhances the aural discrimination of single units and reduces aural fatigue. (5 refs.)

73694 A low-noise low input impedance amplifier for magnetic measurements of nerve action currents. J.P.Wikswo,Jr., P.C.Samson (Vanderbilt Univ., Nashville, TN, USA), R.P.Giffard.
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.215-21 (April 1983).
Describes a low-noise solid-state current-to-voltage amplifier to measure the magnetic fields produced by nerve action currents. The amplifier senses the EMF induced in a toroidal, ferrite-core pickup coil surrounding the nerve by the circumferential magnetic field associated with the axial nerve action currents which propagate past the toroid. In order to obtain low input voltage noise, the input stage of the amplifier consists of 20 preamplifiers in parallel, each containing a discrete bipolar transistor pair. The complete amplifier has an input impedance of 1.33 Ω and a minimum noise figure of 1.5 dB at 100 Hz for a source resistance of 50 Ω. The amplifier has sufficient sensitivity to detect the magnetic field of the action potential propagating along a single giant axon. (17 refs.)

73695 A light-scattering apparatus for the study of cellular suspensions. J.E.Powers (Advanced Technol. Labs., Bellevue, WA, USA), H.Gutekunst, H.Affolter, A.Pletscher, R.G.Buckles.
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.228-31 (April 1983).
A system is described which uses scattered laser light to study the kinetics of cellular suspensions. The scattered light is collected by optical fibers placed at 10° increments around the cuvette. With a novel normalization scheme all outputs are made proportional to the percentage change relative to the values measured upon insertion of the sample. The system includes a noise level detector to give an output proportional to the relative amplitude of fluctuation of the light intensity. The apparatus has been used primarily for the study of human blood platelets. Preliminary results indicate that the noise level is a measure of platelet shape, whereas the average amplitude of light scattered at 40° shows sensitivity to pseudopod formation. Thus, the authors can distinguish between shape change, pseudopod formation, and aggregation of the platelets. (18 refs.)

73696 The quantification and graphic display of correlations among three spike trains. M.Abeles (Dept. of Phys., Hebrew Univ., Jerusalem, Israel).
IEEE Trans. Biomed. Eng. (USA), vol.BME-30, no.4, p.235-9 (April 1983).
The correlation among three nerve cells may be plotted as a three-dimensional graph. On the graph's base all possible sequences of three spikes (one from each spike train) may be represented. The relative abundance of each possible sequence is plotted vertically above this base. The correlation may be estimated by dividing the base into triangular bins and counting the number of occurrences of a particular sequence that fall within each bin. Three types of graphs may be constructed. The covariance function for the three spike trains represents the rate of occurrence of three spike sequences, the compound renewal-density function represents the effect of one spike on the combined firing of the other two cells, and the simple renewal-density function represents the way by which the firing times of two cells affect the firing rate of the third one. (9 refs.)

73697 Water diffusion and measurement of cerebral blood flow by $C^{15}O_2$ inhalation. M.Steinling, J.C.Baron, F.Soussaline, J.Rousseau, D.Comar, R.Naquet, C.Kellershohn (Dept. de Biologie, CEA, Orsay, France).
Int. J. Nucl. Med. & Biol. (GB), vol.10, no.1, p.17-22 (1983).
Measurement of local cerebral blood flow (CBF) using the $C^{15}O_2$ continuous inhalation technique coupled with positron emission tomography (PET) rests on the assumption that the in vivo labelled water ($H_2{}^{15}O$) of blood diffuses freely within the brain water pool. This requirement, however, may be disputed: in the rhesus monkey, Eichling et al. (1974) showed a linear relationship between the single-pass extraction of water (E) and CBF after intracarotid $H_2{}^{15}O$ injection, such that E decreases as CBF increases. Such a limitation in water transport across the blood brain barrier has also been suggested to exist in man (Paulson, 1977). In order to verify its possible effects on measured CBF in baboons, simple computer analysis was performed comparing the data obtained with CBF values reported in similar experiments, but using a freely diffusible inert gas (^{133}Xe). This allowed calculation of a water extraction index which was shown to decline as CBF increased. This result may be considered as a presumption of the part played by the limited water diffusibility on the final CBF values, but other factors must also be considered, such as the inescapable admixture of grey and white matter (partial volume effect), a limitation of present day PET technology. (15 refs.)

73698 Computerized measurement of tongue dorsum movements with pulsed-echo ultrasound. E.Keller (Univ. du Quebec a Montreal, Montreal, Quebec, Canada), D.J.Ostry.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1309-15 (April 1983).
A computerized system for the measurement of tongue dorsum movements with pulsed echo ultrasound is described. The presentation focuses on technical and methodological considerations in the on-line acquisition of vertical tongue movement information, its digital processing and display. Problems associated with transducer placement, peak detection, data averaging, and curve fitting are considered, and validation procedures based on X-ray and indicators of measurement reliability are reported. The discussion centers on advantages and disadvantages of the technique and its applications. (30 refs.)

73699 Reflex inhibition procedures for animal audiometry: a technique for assessing ototoxicity. J.S.Young, L.D.Fechter (Div. of Toxicology, Johns Hopkins School of Hygiene & Public Health, Baltimore, MD, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1686-93 (May 1983).
A procedure for making rapid audiometric assessments of animal subjects, based on the ability of weak stimuli to modify the strength of reflexes elicited by subsequently presented strong stimuli is described. Pure-tone detection thresholds for rates and guinea pigs determined by this procedure are quite comparable to those determined by operant techniques, and are similarly sensitive to ototoxic insult. The procedure is also applicable to the assessment of suprathreshold sensory function, and offers advantages over commonly used procedures for assessing ototoxicity. (28 refs.)

73700 A method for combining field potential recording with local perfusion in the hippocampus of the anaesthetized rat. M.L.Errington, A.C.Dolphin, T.V.P.Bliss (Div. of Neurophysiology & Neuropharmacology, Nat. Inst. for Medical Res., London, England).
J. Neurosci. Methods (Netherlands), vol.7, no.4, p.353-7 (April 1983).
A method is described for combining local perfusion of discrete brain areas and simultaneous recording of field potentials using a push-pull cannula with attached electrodes. The authors used a commercially available concentric push-pull cannula (Plastic Products, Clark Electromedical, UK) whose inner and outer tubes were 0.35 and 0.83 mm o.d. One or more Teflon-coated stainless-steel wire recording electrodes (0.1 mm o.d., Clark Electromedical) were glued with epoxy resin to the outer tube of the cannula, and cut so that their exposed tips protruded slightly beyond it. Experiments performed on rats anaesthetized with urethane (1.5 g/kg, i.p.), held in a stereotaxic head-holder are described. (6 refs.)

73701 The identification of pollen grains using cathodoluminescence in the scanning electron microscope. S.Soni (Dept. of Anatomy, Univ. of Toronto, Toronto, Ontario, Canada).
Scanning (Germany), vol.5, no.1, p.45-6 (1983).
A scanning electron microscope fitted with a sensitive cathodoluminescence detector system has been used for the identification of pollen grains stained with acridine orange or unstained. This approach provides a means of identifying and studying the morphological details of pollens. Cathodoluminescence detection can, in principle, extend the limits of resolution beyond those obtainable with the fluorescence microscope. (8 refs.)

73702 Differentiation of Norway maple cultivars with scanning electron microscopy. C.R.Krause (Nursery Crops Res. Lab., US Dept. of Agriculture, Delaware, OH, USA).
Scanning Electron Microsc. (USA), pt.3, p.1151-4 (1982).
Five cultivars of Norway maple, Acer platanoides L., three of which could not be distinguished from one another by conventional techniques, were differentiated using scanning electron microscopy (SEM). From 1977 through 1981, foliage of 1- and 2-year-old field-grown A. platanoides cultivars was collected at Boring, OR, Princeton, NJ and Delaware, OH. SEM analysis of abaxial foliage revealed differences between cultivars in the overall appearance of the stomatal apparatus as manifested by the arrangement of guard cells and stomatal lips. In addition, the presence or absence of nodulations on trichomes was used to separate other cultivars. Cultivar identification using SEM analysis provided images of structures that are unique to each cultivar of Norway maple. Quality control of nursery stock, patent protection and verification of plant reference collections are possible in this species using SEM. (4 refs.)

73703 Preparation and transfer of ultrathin frozen-hydrated and freeze-dried cryosections for microanalysis in scanning transmission electron microscopy. K.Zierold (Max-Planck-Inst. fuer Systemphysiologie, Dortmund, Germany).
Scanning Electron Microsc. (USA), pt.3, p.1205-14 (1982).
A cooling chain preparation technique is described which enables electron microscopy and X-ray microanalysis of biological cells and tissues on an ultrastructural level. Following this method the biological object is quickly frozen without any chemical pretreatment. Sections of about 100 nm thickness are cut at a temperature below 173K in a cryoultramicrotome by means of a dry glass knife and then they are transferred under cold nitrogen gas atmosphere at 120K in a transfer chamber to the electron microscope. After locking the specimen under vacuum into the cold stage of a scanning transmission electron microscope, analysis of structure and elemental distribution is done at 165K. The technique is illustrated by results of yeast cells, rat liver, guinea pig heart muscle and cultured mouse fibroblast cells. The results are discussed with respect to its present limitations and possibilities. (46 refs.)

Multipulse techniques to edit ^{13} NMR spectra of deuterated compounds. Useful methods to follow deuterium in biosynthesis .... See Entry 70913

Laryngeal vibrations: a comparison between high-speed filming and glottographic techniques .... See Entry 71311

Use of refractometry for studying phasic transitions in flat lipid membranes .... See Entry 73538

Flow visualization in isolated transparent natural blood vessels .... See Entry 73612

Non-thermal effect of UHF pulses of nanosecond duration on the transepithelial transfer of sodium ions .... See Entry 73633

87.90 OTHER TOPICS IN BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

Phase transition in a four-dimensional random walk with application to medical statistics .... See Entry 69990

90.00 GEOPHYSICS, ASTRONOMY AND ASTROPHYSICS

91.00 SOLID EARTH GEOPHYSICS

Note on the relation between the equinox and Guinot's non-rotating origin .... See Entry 73978

91.10 GEODESY AND GRAVITY

(for relations of gravity observations to tectonics and isostasy, see 91.45 Physics of plate tectonics)

73704 Subterranean gravity and other deep hole geophysics. F.D.Stacey (Phys. Dept., Univ. of Queensland, Brisbane, Queensland, Australia).
AIP Conf. Proc. (USA), no.96, p.285-97 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
The early history of the determination of the Newtonian gravitational constant, G, was closely linked with the developments of geodesy and gravity surveying. The current search for non-Newtonian effects that may provide an experimental guide to unification theories has led to the retracing of some of this history. Modern geophysical techniques and facilities, using especially mines and deep ocean probes, permit absolute measurements of G for distance scales up to a few kilometers. Although the accuracy of the very long range determinations cannot equal that of the best laboratory measurements, they are crucial to assessment of the possibility of a scale dependence of G. Preliminary data give values of G on a scale 100-1000 m biased about 1% higher than the laboratory value. Possibilities of systematic error question this apparently significant bias but provide the incentive for better controlled large scale experiments. Several are in progress or under development. A particular difficulty concerns the measurement of in situ density. Even for hard rock, release from overburden pressure causes microcracks and pores to open. Natural pore closure is effective only with deep burial and for this reason there are advantages in deep instrument placement for several geophysical studies. (31 refs.)

73705 Gravimetric terrain corrections in western Canada. J.A.R.Blais, G.D.Lodwick, R.Ferland (Div. of Surveying Engng., Univ. of Calgary, Calgary, Alberta, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.259-65 (Feb. 1983).
Terrain corrections for gravimetric measurements have been studied in terms of accuracy requirements and automated computations. Geodetic and geophysical applications in western Canada have been considered specifically because of complications arising from the rugged topography. Comparing the computation methods of Nagy and Mathisen in relation to the theoretical results, the former is shown to be more reliable with simulated accidented topography. Other approaches are also briefly discussed and general recommendations are made for an optimal technique to compute gravimetric terrain corrections in western Canada. (13 refs.)

73706 Global isostatic geoid anomalies for plate and boundary layer models of the lithosphere. B.H.Hager (Seismological Lab., California Inst. of Technol., Pasadena, CA, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.97-109 (April 1983).
Isostatic geoid anomalies are usually interpreted using a flat-Earth, one-dimensional idealization. Calculations of model isostatic geoid anomalies for the spherical analogues of the plate and boundary layer thermal models show that the 'over the horizon' effect can bias estimates of geoid slopes by over 20%, although the effect is usually less than 5%. The geoid anomalies for these two models are quite different over old ocean basins, but they are unlikely to be distinguishable on the basis of global geoid observations owing to the presence of other larger perturbations in the geoid. Stripping the effects of plate aging and a hypothetical uniform, 35 km thick, isostatically-compensated continental crust from the observed geoid emphasizes that the largest-amplitude geoid anomaly is the geoid low of almost 120 m over West

Antarctica. This anomaly is a factor of two greater in amplitude than the low of 60 m over Sri Lanka. (38 refs.)

73707 Computing the Sun's position in the sky with an accuracy of 1°. Z.Pokorny.
Energetika (Czechoslovakia), vol.33, no.4, p.140-1 (April 1983). In Czech.
Presents computation of the azimuth and height of the Sun in the sky with an accuracy of 1°, which is sufficient for most engineering applications. Input data are the geographical coordinates of the given location, the date and the time of the day. The computation can be carried out readily by means of programmable calculators (the paper presents complete programs for the type TI-58/59 and H-43C calculators). (no refs.)

73708 The geometric correction of LANDSAT-type imagery using perturbation techniques. I.Levine (General Electric Co., Lanham, MD, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.175-9 (April 1983).
A method for geometric correction data calculation is based on decomposition of image distortions into nominal distortions and perturbations, caused by deviations from the nominal spacecraft motion and sensor pointing. The maximal errors of the method are of order of 5 m, and the average errors are less than 0.6 m (σ). (1 ref.)

Density inhomogeneities under island arcs systems ....See Entry 73758
Recomputation of vertical crustal motions near Palmdale, California, 1959-1975 ....See Entry 73776
Recent changes in sea level and their possible causes ....See Entry 73805
Ocean bottom tilt observation system ....See Entry 73948
Note on the relation between the equinox and Guinot's non-rotating origin ....See Entry 73978

91.25 GEOMAGNETISM AND PALAEOMAGNETISM; GEOELECTRICITY

73709 Paleomagnetism of the Deadman's Bay diabase dikes from northeastern central Newfoundland. G.S.Murthy (Dept. of Earth Sci., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.195-205 (Feb. 1983).
Twenty-six oriented samples were collected from six diabase dikes cutting the Deadman's Bay granite of northeastern central Newfoundland for the purpose of paleomagnetic investigations. The dikes probably form part of a general swarm of diabase dikes in this area of Devonian age. Stepwise thermal demagnetization of individual specimens followed by vector subtraction based on Zijderveld plots revealed two characteristic magnetizations: one, a poorly grouped magnetization of $\bar{D}=220.2°$, $\bar{I}=78.0°$, $\alpha_{95}=17.4°$, $\kappa=16$ carried by multidomain magnetite; and a better grouped magnetization of $\bar{D}=202.9°$, $\bar{I}=4.0°$, $\alpha_{95}=10.0°$, $\kappa=42$ residing in hematite. The poles from diabase dikes of the Gander Zone are discussed in the context of other poles from the northern Appalachians. It is concluded that the Devonian poles from Acadia seem to be displaced relative to the cratonic North American poles for that age. (27 refs.)

73710 Paleomagnetism of diabase dikes from the Bonavista bay area of northeastern central Newfoundland. G.S.Murthy (Dept. of Earth Sci., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.206-216 (Feb. 1983).
Paleomagnetic results are reported for a swarm of diabase dikes from the northeastern Gander Zone of the Newfoundland Appalachians. Sixty-eight cores were collected from 19 dikes cutting the various granites and migmatites from the Bonavista Bay area of Newfoundland. From the earlier structural and Rb/Sr age data available, one can infer an age for the dike swarm of between 400 and 330 Ma. Paleomagnetic studies including alternating field and thermal demagnetizations reveal that the swarm can be divided into two groups: group 1 has a characteristic magnetization of $D=296.6°$, $I=82.2°$ with $\alpha_{95}=5.8°$ for $N=14$ dikes with the corresponding pole position at 53.9°N, 77.4°W. One dike's magnetization was found to be reversed relative to the other group 2 dikes. Various magnetic experiments conducted to study the bulk magnetic and remanent magnetic properties of the dike material suggest that their behavior is consistent with multidomain pure magnetic being the dominant magnetic mineral. The group 1 pole position lies close to Newfoundland and is similar to other poles of equivalent age for intrusives from New Brunswick and Newfoundland. Rock units from the southeastern margin of the Iapetus Ocean thus seem to be yielding consistent 'high-latitude' poles, a factor that needs to be taken into account in any discussion of the tectonic evolution of the area. (38 refs.)

73711 Paleomagnetism of the Lac St.-Jean anorthosite and related rocks, Grenville Province, Quebec. K.L.Buchan, W.F.Fahrig, G.N.Freda, R.A.Frith (Geological Survey of Canada, Ottawa, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.246-58 (Feb. 1983).
Alternating field and thermal demagnetization study of the Lac St.-Jean anorthosite and related rock units in the central portion of the exposed Grenville Province reveals two components of magnetization, one of reversed and the other of normal polarity. Both components are thought to have been acquired during the last regional metamorphism, which was sufficiently intense in this area (mostly amphibolite grade) to resent any earlier magnetization. Corresponding paleopoles at 193°W, 8°S (dm=7.3°, dp=4.6°) and 213°W, 19°S (dm=10.5°, dp=8.5°) lie along the 950-900 Ma segment of the recently calibrated Grenville track of the North American apparent polar wander path, a track that has thus far been defined largely by results from rock units of the western Grenville. (35 refs.)

73712 Paleomagnetism of the Borden dykes of Baffin Island and its bearing on the Grenville Loop. K.W.Christie, W.F.Fahrig (Geological Survey of Canada, Ottawa, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.275-89 (Feb. 1983).
Northern Baffic Island is intersected by spectacular swarms of predominantly northwesterly trending diabase dykes. Cross-cutting relationships, K-Ar ages, and paleomagnetic contact tests indicate that these dykes represent at least two other episodes of Hadrynian igneous activity. The Borden dykes were emplaced during the earlier of these episodes. They are about 950 Ma old and have a paleomagnetic pole position of 153.3°E, 26.7°S, $\delta m=8.6°$, $\delta p=6.1°$. The later episode saw the emplacement of the previously defined Franklin dykes, which are about 750 Ma old. The newly defined Borden pole lies at the southern extremity of the Grenville Loop and has an age consistent with poles of similar position that were derived from rocks of the Grenville Province. All of the dykes probably reflect tension acting in an east-northeast—west-southwest direction. The directions of thick northwest trending dykes, which form a considerable angle to that expected from east-northeast tension, are thought to have been controlled by earlier (circa 1200 Ma) fractures of the Borden fault zones. The two main surges of magma may coincide with two periods of Hadrynian uplift in the Boothia Peninsula area to the west. (10 refs.)

73713 Magnetic inclination of basaltic rocks from the East-Pacific Rise at 21 degrees North and validity of polarity criteria. B.Smith (Lab. de Geomagnetisme, Univ. de Paris VI, Saint Maur des Fosses, France).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.322-33 (Feb. 1983). In French.
22 samples have been selected according to macroscopic, oriented criteria (elongation plane of feeder tubes in sheeted lavas, bubbles and gas cavities, stalacites, septa) from which the polarity of a sample, acquired in situ during its cooling, could be established. The natural remanent magnetization intensity of these generally voluminous samples (up to about 350 cm^3) has a mean value of 11.35 ± 2.31 $A.m^{-1}$; the scatter of the values can be explained by the varying proportion of nonmagnetic material (glass, Mn) in the samples. The magnetic viscosity is always negligible and the stability of the remanent magnetization direction after alternating field demagnetization indicates that the stable direction determined is the direction of the original thermoremanence. Despite the relatively low latitude, which makes the occurrence of negative magnetic inclinations within a normal polarity period (Brunhes, in this case) more probable, no reverse polarity has been found. The mean inclination of the 22 samples is $I=+41.8\pm16.7°$ and becomes $I=+42.2\pm19.4°$ if the samples are grouped in 15 pinpoint sampling sites; these values are not significantly different from those of the local dipole field or from those of the actual local field. The scatter of the magnetic inclination values is more tightly bound to the quality of the polarity criteria than to the secular variation of the Earth's magnetic field. It appears from this study that macroscopic polarity criteria may be used in an almost systematic way to find the polarity of an in situ sample. (27 refs.)

73714 Paleomagnetism of Archean volcanics and Proterozoic dikes in La Grande Riviere area of Nouveau-Quebec. M.K.Seguin (Dept. de Geologie, Univ. Laval, Ste-Foy, Quebec, Canada), K.N.M.Sharma, GF.Woussen, K.St.Seymour, D.T.A.Symons.
Can. J. Earth Sci. (Canada), vol.20, no.2, p.339-43 (Feb. 1983).
Paleomagnetic results are reported for six Archean volcanics and six Proterozoic diabase dike sites in the La Grande Riviere basin using AF and thermal demagnetization. The limited geological and statistical data base makes interpretation of the results necessarily tentative. The dikes yield an A component pole at 84°W, 74°N from magnetization residing in higher stability domains, which likely reflects emplacement either at ~2150 or ~1825 or ~1650 Ma ago, and a B component pole at 33°W, 4°S residing in lower stability domains, which likely reflects metamorphism during the Hudsonian Orogeny at ~1725 Ma, or, less likely, during Grenvillian uplift at ~975 Ma. The volcanics appear to yield a prefolding C component pole at 28°W, 49°S that dates extrusion at ~2900 Ma and a postfolding D component pole at 306°W, 37°N that dates metamorphism by the Kenoran Orogeny at ~2600 Ma. (15 refs.)

73715 Paleomagnetism of Late Archean metavolcanics and metasediments, Abitibi orogen, Canada: tholeiites of the Kinojevis Group. J.W.Geissman, D.W.Strangway, A.M.Tasillo-Hirt (Dept. of Geology, Univ. of Toronto, Toronto, Ontario, Canada), L.S.Jensen.
Can. J. Earth Sci. (Canada), vol.20, no.3, p.436-61 (March 1983).
Iron-rich and magnesium-rich basaltic tholeiites of the latest Archean Kinojevis Group, central Abitibi Belt, northeastern Ontario, contain a natural remanent magnetization that is generally multivectorial. The components in all units reside in essentially pure magnetite, not the original titanomagnetites. Any original TRM was lost by chemical reconstitution of the magnetic oxides in response to primary deuteric conditions, long-term burial, regional metamorphism to prehnite-pumpellyite facies, and possibly intrusion by Matachewan dikes. Data from contact tests with Matachewan dikes indicate that the units are indeed capable of retaining a very latest Archean—earliest Proterozoic field. High-coercivity, high-blocking-temperature directions from samples from other flows, and paleomagnetic data from Kinojevis tholeiites are discussed. (82 refs.)

73716 A magnetic profile and inferred seafloor spreading in Foul Bay, Red Sea. M.M.Khattab (Dept. of Geology, United Arab Emirates Univ., Alain, United Arab Emirates).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.110-12 (April 1983).
A profile taken across the aeromagnetic coverage of Foul Bay and the adjacent north Benas Bay indicates seafloor spreading. The best synthetic-to-observed profile fit was for spreading to have occurred, along a NNE axis, between 22 and 5 Ma ago at a rate of 0.5 cm/yr. In this interval extensive basic volcanicity was occurring in eastern Egypt. A nearly continuous spreading phase of this span of time, in a direction parallel to the present-day spreading axis, is suggested. (12 refs.)

73717 The unique solution of the inverse problem in electrical surveying and electric well-logging for piecewise-continuous conductivity. V.L.Druskin (Central Geophys. Expedition, Min. of Petroleum Industry, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.1 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.1, p.51-3 (1982).
A unique solution is proven for the determination of a conductivity function in a medium consisting of arbitrary regions with constant conductivity and piecewise-smooth boundaries; for a three-dimensional problem in electrical surveying, with the possibility of locating points measurement and supply electrodes at any point on a given portion of the Earth's survey; and for a two-dimensional problem in axisymmetric electric well-logging with the location of measurement and supply electrodes at any point on a given segment on the drill-hole axis. (3 refs.)

73718 Electrical conductivity of the Earth's crust and the upper mantle in Kamchatka, based on data from magnetotelluric logging. Yu.F.Moroz (Eastern Geophys. Trust, Min. of Geology, USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.1, p.54-61 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.1 (1982).
The deep structure is considered for Kamchatka, on the basis of results of magnetotelluric logging carried out in 1970-1978. Three zones are distinguished by different geoelectric profiles for the crust and upper mantle. In these zones are layers of reduced resistivity at depths of 100-150, 30-50, and 8-15 km. The nature of the conducting layers is discussed. The features manifested for the geoelectric profile of the crust and upper mantle find reflection in the tectonics, magmatism, heat field, and hydrothermal activity of the region. (35 refs.)

73719 A Miocene polarity transition (R-N) from the Agno Batholith, Luzon. I.Williams, M.Fuller (Dept. of Geological Sci., Univ. of California, Santa Barbara, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9408-18 (10 Nov. 1982). [received: May 1983]
A geomagnetic reversal record has been obtained from the Agno Batholith (16°15'N, 120°39'E) in Luzon Island, the Philippines. This body is a biotite-hornblende quartz diorite dated at between 14.5 and 15.0 m.y. Hysteresis properties show that the magnetic remanence is dominated by multidomain, low-titanium titanomagnetite. A stable component of magnetization is isolated

upon both thermal and alternating field demagnetization. The reversed-to-normal reversal sequence has a far-sided VGP path and a decrease in intensity of magnetization of approximately a factor of 5, with a longer duration than the directional change. The VGP path is confined in a longitudinal band 120° from the site and so differs from the characteristic reversed-to-normal transition paths in that it is not near-sided. The Agno reversal record is consistent with a quadrupole field and reversal initiated in the northern hemisphere. (26 refs.)

73720 Hydromagnetic waves in a differentially rotating sphere. D.R.Fearn, M.R.E.Proctor (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.128, p.1-20 (March 1983).
The linear stability of a uniformly internally heated, self-gravitating, rapidly rotating fluid sphere is investigated in the presence of an azimuthal magnetic field $B_0(r,\theta)\hat{\phi}$ and azimuthal shear flow $U_0(r,\theta)\hat{\phi}$ (where (r,θ,ϕ) are spherical polar coordinates). Solutions are calculated numerically for magnetic field strengths that produce a Lorentz force comparable in magnitude to that of the Coriolis force. The critical Rayleigh number R_c is found to reach a minimum here and the qualitative behaviour of the thermally driven instabilities in the absence of a shear flow ($U_0=0$) is similar to that found by earlier workers (e.g. Fearn 1979*b*) for the simpler basic state $B_0=r \sin \theta$. The effect of a shear flow is followed as its strength (measured by the magnetic Reynolds number R_m) is increased from zero. (34 refs.)

73721 The stabilizing role of differential rotation on hydromagnetic waves. D.R.Fearn, M.R.E.Proctor (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Fluid Mech. (GB), vol.128, p.21-36 (March 1983).
The role that differential rotation plays in the hydromagnetic stability of rapidly rotating fluids has recently been investigated by the authors (1983) as part of a wider study related to the geodynamo problem. Starting with a uniformly rotating fluid sphere, the strength of the differential rotation was gradually increased from zero and several interesting features were observed. These included the development of a critical region whose size decreased as the strength of the shear increased. The resolution of the two-dimensional numerical scheme used in the authors' earlier study is limited, and consequently it was only possible to consider small shear strengths. This is unfortunate because differential rotation is probably an important effect in the Earth's core and a more detailed study at higher shear strengths is desirable. The author's are able to achieve this by studying a rapidly rotating Benard layer with imposed magnetic field $\mathbf{B}_0=B_M s\hat{\phi}$ and shear $\mathbf{U}_0=U_M s\Omega(z)\hat{\phi}$, where (s,ϕ,z) are cylindrical polar coordinates. (20 refs.)

73722 Magnetometer arrays and geodynamics. D.I.Gough (Inst. of Earth & Planetary Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.87-95. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
The use of large two-dimensional arrays of recording magnetometers, to observe time-varying magnetic fields in the period range 15-150 minutes, has led to the discovery and mapping of several large, conductive structures in the crust and upper mantle. In the western United States the observations are well fitted by induced currents flowing in the upper mantle, and the regions of high conductivity correlate well with high heat flow and with seismological evidence of partial melting. A narrow conductor at crustal depths joins the northern end of the Southern Rockies in Wyoming to the Black Hills of South Dakota and to the Wollaston Domain of north central Saskatchewan. In southern Africa two major crustal conductors have been well mapped by four array studies. One conductor revealed a hitherto unrecognized southwestward extension of the Luangwa-Zambezi Rift and saline water in fractures may provide the high conductivity. The other conductor underlies the tip of the continent south of 30°S. (22 refs.)

Mapping the Miocene Farallon Ridge jump on the Pacific plate: a seismic line of weakness .... See Entry 73742

Some aspects of tectonic history of the Holy Cross Mountains in the light of palaeomagnetic studies .... See Entry 73751

Paleomagnetic constraints on the Late Cretaceous and Cenozoic tectonics of southeastern Asia .... See Entry 73774

Drill stem resistance effects in electric telemetry links .... See Entry 73937

91.30 SEISMOLOGY

73723 Seismicity induced by surface mining: the Belchatow, Poland, earthquake of 29 November 1980. S.J.Gibowicz, B.Guterch, H.Lewandowska-Marciniak (Inst. of Geophys., Polish Acad. of Sci., Warsaw, Poland), L.Wysokinski.
Acta Geophys. Pol. (Poland), vol.30, no.3, p.193-219 (1982).
On 29 November 1980 a magnitude 4.6 earthquake occurred in the brown coal mining area of Belchatow in central Poland. The seismic moment, source radius and stress drop are considered. The fault plane solution, found from P-wave first motions at twenty-eight stations, is discussed. The depth is estimated. Although the removal of the overburden and drainage of coal deposits by water withdrawal seem to be direct factors responsible for stress concentration, the preexisting tectonic stress is probably the most important indirect factor responsible for the origin of the Belchatow event. (46 refs.)

73724 Periodicity of strong mining tremors in the Lubic copper mine. A.Kijko, M.M.Dessokey, E.Glowacka (Inst. of Geophys., Polish Acad. of Sci., Warsaw, Poland), M.Kazimierczyk.
Acta Geophys. Pol. (Poland), vol.30, no.3, p.221-30 (1982).
The mining tremors recorded in the area of the Lubin copper mine in Poland from 1972 to 1980 are analyzed. The trend of increasing energy of the shocks with time, which appears from the data, is removed. The first and third Gumbel extreme values distribution are applied to estimate the probabilities of occurrence and return periods of tremors with different energies. It is found that the third Gumbel distribution fits the observations better than the first one, similarly for the case of natural earthquakes. The maximum expected energy for the next five years, is calculated with a probability 0.99 using the third Gumbel distribution. (12 refs.)

73725 The velocity anisotropy of rock mass and location accuracy of mining tremors. B.Drzezla, A.Mendecki (Mining Dept., Silesian Tech. Univ., Kosciuszki, Poland).
Acta Geophys. Pol. (Poland), vol.30, no.3, p.231-41 (1982).
One of the main problems in studies of the rock mass state in mines, by seismic and seismoacoustic methods, is the exact location of determination of the seismic events. The methods based on the assumption that the rock mass is an isotropic medium seem to be insufficient, though they are still being improved. The influence of anisotropy intensity and its geometry in the rock mass, with respect to the seismic networks, on the location errors resulting from the use of 'isotropic method' is investigated. (14 refs.)

73726 Interaction of shear cracks in an external stress field. J.Niewiadomski (Inst. of Geophys., Polish Acad. of Sci., Warsaw, Poland).
Acta Geophys. Pol. (Poland), vol.30, no.3, p.243-52 (1982).
Presents calculations for a system of shear cracks in an external stress field. Special attention is paid to the problem of inhomogeneity of the material in which the system of cracks exists. The calculations are useful for an explanation of the spatial distribution of aftershocks. (10 refs.)

73727 Strong motion prediction using mathematical modeling techniques. K.Aki (MIT, Cambridge, MA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S29-41 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
The purpose of the present paper is to present the state of the art in The purpose of the present paper is to present the state of the art in predicting strong ground motion from the basic understanding of fault mechanics and seismic wave propagation. The mathematical foundation of the current work in this area was firmly established in the early 1960s by Maruyama (1963) and Burridge and Knopoff (1964) who showed that the point-force equivalent of a fault slip is a double couple and the seismogram can be computed by a space-time convolution of slip function with Green's function. The slip function describes the fault displacement during an earthquake as a function of time and position on the fault plane. Green's function here is the response of the Earth when an impulsive double couple is applied at a point on the fault plane. The slip-function and Green's function express quantitatively by the source and the propagation effect, respectively, on seismic motion. (80 refs.)

73728 The empirical prediction of ground motion. D.M.Boore, W.B.Joyner (Office of Earthquake Studies, US Geological Survey, Menlo Park, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S43-60 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Recent additions to the strong-motion data set, primarily from earthquakes in California and Italy, are responsible for a large number of papers examining the prediction of ground-motion measures using regression methods. Peak acceleration is still the most common measure being considered, but increasing attention is being given to peak velocity and spectral amplitudes. Although direct comparisons among the studies are hampered by differing definitions of distance and magnitude, in general the various studies give similar answers for peak acceleration in the region of distance and magnitude space in which most of the data are concentrated. As might be expected, the differences are most pronounced for large magnitudes and distances close to the fault, where data are few. Even so, widely differing assumptions about the form of the regression equation and differences in the composition and weighting of the data set can give similar answers. A Monte Carlo study shows that the question of whether the shape of the attenuation curves is magnitude-dependent cannot be resolved by existing data. (39 refs.)

73729 Seismic event discrimination. R.R.Blandford (Teledyne Geotech, Alexandria, VA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S69-87 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Discrimination of small events begins with detection, association, and location. The author describes recent advances in detection, association and location techniques. The author then discusses earthquake sources mechanisms and compares them to nuclear explosions. The seismic waves radiated by each type of event are considered. The possibility of detecting the type of event from the teleseismic wave field is assessed. (83 refs.)

73730 Test ban treaty verification with regional data—a review. P.W.Pomeroy, W.J.Best, T.V.McEvilly (Rondout Associates Inc., Stone Ridge, NY, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S89-129 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Summarizes the use of regional ($\Delta \leq 30°$) seismic data in a test ban context for detecting, locating, identifying, and determining the yield of underground nuclear explosions. In many areas of the world *Lg* is the largest amplitude wave recorded on standard seismograph systems and thus is the most appropriate phase for monitoring small magnitude events. Excellent location capability for near-regional events has been demonstrated at the Norwegian small aperture array (NORESS) using *Lg* and *P* waves. *Lg* and other regional phases may contain information on source depth. Fifteen classes of regional discriminants have been identified including 1. First Motion, 2. $M_S{:}m_b$, 3. P^2/P^1 Ratio, 4. Excitation of Short-Period *SH* Waves, 5. *Lg*/*Rg* Amplitude Ratios, 6. *Pn*/*Lg*, *Pg*/*Lg*, and P_{max}/Lg Amplitude Ratios, 7. *Lg* Group Velocity and Energy Ratios in *Lg*, 8. Excitation of *Sn*, 9. Third Moment of Frequency, 10. Generation of Higher Mode Surface Waves, 11. Peak Amplitudes of Love and Rayleigh Waves and Long-Period Surface Wave Energy Density, 12. Prevailing Period of Long-Period Love Waves, 13. Spectral Ratio-Long-Period *S* Waves to Rayleigh Waves, 14. Spectral Ratio-Long Period Love Waves to Rayleigh Waves, 15. Frequency of the Peak Spectral Amplitudes and Spectral Ratios in *Pn*, *Pg*, *S*, and *Lg*. Each of these proposed discriminants has, with differing degrees of success, separated some explosions from some earthquakes. The major conclusion of this study is that a systematic and comparative evaluation of all the proposed regional discriminants is now required, utilizing a common data base derived from all present-day test sites. (104 refs.)

73731 Estimating the yield of underground nuclear explosions. T.C.Bache (Defense Advanced Res. Projects Agency, Arlington, VA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S131-68 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
This article summarises the current state of understanding of the technical issues involved in the methods employed to estimate the yield of underground nuclear explosions. m_b and M_b data derived from short-period teleseismic P-waves can be used but detailed knowledge of source-region and travel-path differences between known and unknown yield events must be known. (134 refs.)

73732 The effect of attenuation on seismic body waves. V.F.Cormier (Lincoln Lab., MIT, Cambridge, MA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S169-200 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Reviews of body-wave attenuation have been conducted from the viewpoint of predicting the regional variation of strong ground motion or from the viewpoint of constructing path corrections to reduce the scatter in network estimates of m_b. Recent reviews include those by Lundquist et al. (1980), Chung and Bernreuter (1981a, b), and Der et al. (1982; unpublished observations) and contributions to a report on the effect of attenuation on yield estimation from m_b (Defense Advanced Research Projects Agency, 1982). This review

will incorporate and synthesize the material of these reviews and attempt to give a balanced appraisal of experimental results. Further research will be suggested for resolving the frequency and regional dependence of attenuation and for reducing the scatter due to attenuation in network estimates of source size using m_b and other measures. (140 refs.)

73733 Application of arrays in the detection, location, and identification of seismic events. F.Ringdal, E.S.Husebye (NTNF/NORSAR, Kjeller, Norway).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S201-24 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
The purpose of this paper is to review the application of seismic arrays to the problem of verifying adherence to a potential comprehensive nuclear test ban treaty. Ever since technical discussions on this subject started in the late 1950s, the focus has been on the problems involved in detecting, locating, and identifying low-magnitude seismic events. In this paper, the concept of seismic arrays, their general objectives and design considerations are discussed. A brief historical survey of array developments to date is provided. The operational aspects of seismic arrays, and the achievements that have been made both in the field of event detection, location, and identification and in general seismological research are reviewed. Finally the likely future developments of the array concept are briefly discussed. (87 refs.)

73734 Body-wave seismograms in inhomogeneous media using Maslov asymptotic theory. C.H.Chapman, R.Drummond (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S277-317 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Asymptotic ray theory is widely used to describe body waves in inhomogeneous media, but caustics, shadows, critical points, etc. have to be treated as special cases. Unfortunately, these singularities are often the points of greatest interest as they are caused by inhomogeneities in the model. Transform methods, e.g. the reflectivity method and WKBJ seismograms, are used to investigate waves at these singular points but are restricted to laterally homogeneous media. Maslov asymptotic theory uses the ideas of asymptotic ray theory and transform methods, combining the advantages—simplicity and generality—of both techniques. In this paper, Maslov asymptotic theory is developed for the computation of body-wave seismograms. (57 refs.)

73735 Scattering and attenuation. K.Aki (MIT, Cambridge, MA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S319-30 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
An extensive existence of strong small-scale heterogeneity in the Earth is suggested by the great variability of direct waves and remarkable stability of scattered waves, both in the case of teleseismic *P* coda and in the case of local earthquake *S* coda. Quantitative studies of small-scale heterogeneities have been made by the following three methods. A lower bound of heterogeneity in the lithosphere has been estimated by the deterministic or stochastic modelling of travel-time and amplitude fluctuation of teleseismic *P* waves across a large aperture seismic array. An upper bound of heterogeneity has been estimated by modeling the attenuation of *S* waves as a scattering loss due to heterogeneity. These two approaches suggest the existence of heterogeneity with rms velocity fluctuations from 3 to 10 per cent. The third method is based on the estimation of heterogeneity from the amplitude of coda waves. The author found a significant discrepancy between the result obtained by the third method and those from the first two, and attribute the discrepancy to the assumption of a single-scattering model adopted in the coda generation theory. (43 refs.)

73736 Earthquake prediction—1982 overview. C.R.Allen (California Inst. of Technol., Pasadena, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S331-5 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Short-term earthquake prediction represents a more difficult scientific problem than was thought 5 yr ago when the National Earthquake Hazards Reduction Program (USA) commenced, and progress has not been as rapid as initially hoped. At this point, reasons can be cited for both encouragement and discouragement. Despite slow progress, the goal of short-term prediction remains realistic, and research should continue vigorously, albeit with some changes in scientific strategy. In contrast, progress in long-term prediction and hazard evaluation has been far more rapid than initially envisaged. (no refs.)

73737 A strategy for short-term prediction of earthquakes. B.Raleigh (Columbia Univ., Palisades, NY, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S337-42 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Physical processes leading to laboratory rupture have a nonlinear character which justifies optimism that earthquakes are predictable. However, nonlinear effects at the source of a smaller earthquake may be an insufficient basis for the prediction of an earthquake with rupture lengths tens to hundreds of kilometers. Thus, a strategy for predicting such major or great events must depend on knowing the state of readiness of the entire length of the suspect fault. The two most promising avenues are: (1) to search for variations in shear and dilatational strains within the fault zone and in the bordering regions that signify the onset of a Stuart instability; and (2) to follow in detail the seismicity in response to the temporal variations of shear and normal strains as a measure of what parts of a long fault are at the point of failure. An observational strategy based on these physical models requires detailed and frequent to continuous observation of strain within the fault and border zones. Focal mechanisms and accurate locations of earthquakes $M \geq 2$ are needed to relate seismicity to a given configuration of the strain field. (12 refs.)

73738 Earthquake prediction: what we have learned and what we should do now. J.F.Evernden (Office of Earthquake Studies, US Geological Survey, Menlo Park, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S343-9 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Adopting out of necessity a definition of 'earthquake prediction' which stresses short-term warnings (months, weeks, day, and hours), the author concludes that either current research is doing the wrong things or such predictions may be impossible. Assuming the former, the author recommends major emphasis on direct or nearly direct measurements of stress/strain change in or across fault zones in the immediate vicinity of strong points or 'asperities' (how do you find asperities?). This recommendation presupposes essentially total emphasis of the United States' program in California. Even if this recommendation is unpalatable, it is certain that resources now available require a total reanalysis of the present program and a consequent reallocation of funds. (no refs.)

73739 Variations in seismicity as a fundamental tool in earthquake prediction. K.C.McNally.
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S351-66 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Refraining from expressing mere opinions, this report attempts to classify and synthesize results of recent seismological studies for earthquake prediction in order to allow the reader to make an independent evaluation of the progress of this program to date. The general conclusion is that significant progress has been made in the research for earthquake prediction during the last 5 yr. Eighty-six references are cited which have been published during this time period. This report is intended as an overview, and the references cited are not a complete list of all works related to the rather broad topic. The reader can obtain detailed references for a particular aspect by referring to the works cited. (136 refs.)

73740 Comparison of earthquake prediction approaches in the Tokai area of Japan and in California. J.F.Davis, P.Somerville (Div. of Mines & Geology, California Dept. of Conservation, Sacramento, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S367-92 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
The Japan Meteorological Agency (JMA) has lead responsibility to predict the anticipated $M8+$ Tokai earthquake which can seriously affect Shizuoka prefecture and environs. The Japan Meteorological Agency maintains a continuous staff observation of records from onshore and offshore seismic stations (events to $M1$), strainmeters, tiltmeters, tide gauges, and ground water conditions. The Earthquake Assessment Committee, composed of six seismologists, has the responsibility to predict the Tokai event based upon this Japan Meteorological Agency data. They expect to provide a short-term prediction with a lead time of hours to several days. The prediction criteria used by the JMA are described. California relies upon the California Earthquake Prediction Evaluation Council and the National Earthquake Prediction Evaluation Council to appraise predictions coming from either government laboratories or university sources. Review of observational data and procedures for making prediction conclusions are more decentralized and informal in California. (30 refs.)

73741 Acoustic waves: a finite difference film. G.McMechan, B.Price (Pacific Geosci. Centre, Earth Phys. Branch, Sidney, BC, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.3, p.506-8 (March 1983).
A finite difference solution of the acoustic wave equation is an ideal basis for making movies since the computations naturally provide a series of frames at successive, discrete time increments. Each time frame contains a picture of the wavefield present at that time. An example is illustrated in a short (~2.8 min) 16 mm film that shows the dynamic response of a two-dimensional model to a point source. The model consists of a layer of varying thickness that overlies a half space. The film shows the point source expanding into a circular wavefront that is reflected, refracted, and diffracted by the model. (3 refs.)

73742 Mapping the Miocene Farallon Ridge jump on the Pacific plate: a seismic line of weakness. E.A.Okal, J.-M.Bergeal (Dept. of Geology & Geophys., Yale Univ., New Haven, CT, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.113-22 (April 1983).
Bathymetric and magnetic data are used to obtain estimates, on the Pacific and Nazca plates, of the boundaries separating lithosphere generated at the old Farallon Ridge from the more recent one created at the present-day East Pacific Rise. An excellent correlation is found with the sites of known teleseismically recorded intraplate seismicity, suggesting that these boundaries, which are lines of age discontinuity in the plate, must be zones of weakness of the lithospheric plate. (30 refs.)

73743 Chronology and development of the 1980 earthquake at El Asnam (Algeria): a postscript. Y.Thommeret (Centre Sci. de Monaco, Monaco), G.C.P.King, C.Vita-Finzi.
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.137-8 (April 1983).
Radiocarbon dating has now confirmed the alluvial chronology that was used in assessing the extent of deformation during the 1980 El Asnam earthquake. It also supports the suggestion that earlier movements were related to a hypocentre further to the east. (5 refs.)

73744 An application of syntactic pattern recognition to seismic discrimination. Hsi-Ho Liu, King-Sun Fu (Electrical Engng., Purdue Univ., West Lafayette, IN, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.125-32 (April 1983).
Two syntactic methods for the recognition of seismic waveforms are presented. The seismic waveforms are presented by strings of primitives. Primitive extraction is based on cluster analysis. Finite-state grammars are inferred from the training samples. The nearest-neighbor decision rule and error-correcting finite-state parsers are used for pattern classification. While both show equal recognition performance, the nearest-neighbor rule is much faster in computation speed. The classification of real data for earthquake/explosion is presented as an application example. (20 refs.)

73745 Design of matched filters and related frequency selective filters for the detection of teleseismic events. W.W.Stammler (Lehrstuhl fur Nachrichtentech., Univ. Erlangen, Erlangen, Germany).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.133-40 (April 1983).
Matched filters and related frequency selective filters are designed for the automatic detection of weak teleseismic earthquake signals. After a presentation of alternative design procedures, practical aspects of the filter realization are discussed. Simulation results indicate significant SNR gain. (13 refs.)

73746 A comparison of synthetic p-tau sections for proposed models of two ophiolites. T.M.Brocher, W.C.Kempner, J.F.Gettrust (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9355-64 (10 Nov. 1982). [received: May 1983]
Analyses of slant stacks of synthetic record sections generated from velocity models for ophiolites by the reflectivity method show that even 90-km-long refraction lines having a 10-Hz source and a 1-km intertrace spacing barely distinguish between fine-scale crustal structures which are of current interest. Such data are sufficient, however, to distinguish between young and old oceanic crust. Tripling the spatial sampling period degrades the quality of the synthetic slant stacks for this temporal frequency content. A major implication of the study is that most currently available field data, being sparser and poorer in quality (due to both noise and instrument responses), offer little hope of resolving thin low-velocity layers or small changes in velocity gradients by using newly proposed inversion techniques based on slant stacking. Last, a simple, first-order correction to a downward continuation algorithm,

namely the inclusion of the phase shift caused by postcritical reflection at each ray parameter, is proposed. (49 refs.)

73747 Rapid F-K migration of zero offset marine reflection data. J.A.Carter, L.N.Frazer (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9365-73 (10 Nov. 1982). [received: May 1983]
Recently developed frequency-wave number migration algorithms have made it possible to migrate digitally recorded zero-offset reflection data economically. The greatest contributions to the speed of these methods lie in the well-known symmetries of the Fourier transform and the assumption of a constant velocity section. In this paper the authors address some of the problems that can arise when F-K migration is used on single channel (or stacked multichannel) reflection data. These problems include incorrect phase shifts caused by use of a two-dimensional method to treat data gathered in a three-dimensional world, overmigration and undermigration because of errors in the velocity function used to migrate, spatial aliasing due to an insufficient density of shots or receivers, and the effects of automatic gain control when applied before migration. (18 refs.)

73748 Computation of theoretical SH seismograms with a finite source. E.Mantovani (Osservatorio Geofisico Univ. di Siena, Siena, Italy), E.Boschi.
Nuovo Cimento C (Italy), vol.5C, ser.1, no.5, p.528-36 (Sept.-Oct. 1982). [received: May 1983]
Generates complete theoretical seismograms, which include both body and surface waves, for realistic sources buried in a radially heterogeneous, anelastic, spherical Earth. The effect of the source finiteness on the time series is investigated by simulating rupture propagation along a fault plane with a series of point sources distributed along a straight line. On the time series, this source model seems to produce, by increasing the time duration of the rupture, a broadening of the body wave bursts, a shortening of the time lag between the phases *S* and *sS*, and a decrease in the amplitude of body waves relative to surface waves. (15 refs.)

73749 The structure, density, and homogeneity of the Earth's core. B.A.Bolt, R.A.Uhrhammer (Seismographic Station, Univ. of California, Berkeley, CA, USA).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.28-37. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Some recent independent results on the structure and physical state of the core are compared. Despite recent refinements, the present resolution of the P and S velocity gradients places considerable limitations on the sharpness of inferences on dynamical properties, density stratification and deviations from adiabatic conditions. (38 refs.)

Annual Meeting of the Seismological Society of America ....See Entry 69776

Tectonic and geologic evolution of southeast asian seas and islands. Pt.2 ....See Entry 69796

Public perceptions of seismic hazards and critical facilities .....See Entry 69855

Density inhomogeneities under island arcs systems ....See Entry 73758

Structure and origin of the J Anomaly Ridge, western North Atlantic Ocean ....See Entry 73763

Deep crustal structure: implications for continental evolution ..See Entry 73768

Geo-acoustic models for propagation modelling in shallow water ....See Entry 73802

Acoustic ocean with a propagation in the poro-elastic bottom ....See Entry 73811

Evidence of pre-late Wisconsinan glaciations on Labrador Shelf—Cartwright Saddle region ....See Entry 73842

Seismological station of the Institute of Geophysics, Polish Academy of Sciences, in the Hornsund Fiord, Spitsbergen ....See Entry 73926

The resolution of seismic instruments used in treaty verification research ....See Entry 73928

Automatic phase pickers: their present use and future prospects ....See Entry 73929

Global digital networks—current status and future directions . See Entry 73930

Digital processing of regional network data ....See Entry 73931

Determination of the coefficients of absorption and scattering by a combined analysis of regular waves and coda ....See Entry 73936

Ocean bottom tilt observation system ....See Entry 73948

91.35 EARTH'S INTERIOR STRUCTURE AND PROPERTIES

73750 Optical properties of the Earths mantle: refraction of temperature radiation. S.Maj (Inst. of Geophys., Polish Acad. of Sci., Warsaw, Poland).
Acta Geophys. Pol. (Poland), vol.30, no.3, p.253-60 (1982).
The molecular refraction of temperature radiation in the Earth's mantle is derived. The calculations are based on the Lorentz electron theory of solids. The characteristic frequency of elementary electron oscillators is identified with the energy gap of a solid. The assumption is that solid material related to the Earth's mantle obeys Birch's law and its energy gap is about 9 eV. (10 refs.)

73751 Some aspects of tectonic history of the Holy Cross Mountains in the light of palaeomagnetic studies. M.Lewandowski (Inst. of Geophys., Polish Acad. of Sci., Warsaw, Poland).
Acta Geophys. Pol. (Poland), vol.30, no.3, p.261-77 (1982).
Selected upper palaeozoic and lowest mesozoic sedimentary rocks from the western part of the Holy Cross Mountains were palaeomagnetically analyzed. Thermal and AF cleaning revealed the presence of several characteristic remanent magnetizations of both pre-folding and secondary origin. The directions roughly coincide with the zone of appearance of characteristic directions for the Russian platform and the Eurasia continent. The palaeomagnetic dating of the secondary directions shows that, generally, they are not younger than the Triassic, thus post-dating some fold structures of uncertain age. Stable Late-Mesozoic overprints are not observable, which may be a consequence either of a smaller thickness of the Mesozoic cover than that estimated today, or of a changed paleo-heat-flow in the Holy Cross Mountains area at the end of the Mesozoic. (24 refs.)

73752 Tectonic significance of Cameron's Line in the vicinity of the Hodges Complex—an imbricate thrust model for western Connecticut. C.Merguerian (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
Am. J. Sci. (USA), vol.283, no.4, p.341-68 (April 1983).
Cameron's Line is a major tectonic boundary in the western part of the core zone of the New England Appalachians. It separates metamorphosed shelf and transition-zone rocks to the west from eugeosynclinal rocks to the east. In western Connecticut it separates the Waramaug Formation from the Hartland Formation and is marked by a zone of structural discordance characterized by intense localized folding (F_2), transposition of structures, truncation of Hartland subunits, and shearing under metamorphic conditions. The Hodges Complex, which engulfs Cameron's Line in northwestern Connecticut, is a small mass of pyroxenite, hornblendite, gabbro, and diorite. The Hodges pluton is not sheared or offset along Cameron's Line. Rather, a narrow, statically recrystallized contact aureole with coexisting cordierite-kyanite-staurolite-biotite-garnet is overprinted on the fold-fault fabric (S_2). The intrusion, therefore, postdated isoclinal folding, early metamorphism, and the development of Cameron's Line. Thus, it is unlikely that this mafic-ultramafic mass is an ophiolite despite its occurrence at a major tectonic boundary. Cameron's Line is interpreted as a ductile fault that developed at the deep levels of a west-facing Taconic accretionary prism. Other aspects of the tectonics of this area are discussed. (59 refs.)

73753 The southern Caspian: a compressional depression floored by a trapped, modified oceanic crust. M.Berberian (Dept. of Earth Sci., Bullard Labs., Univ. of Cambridge, Cambridge, England).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.163-183 (Feb. 1983).
The south Caspian intracontinental depression, floored by oceanic basement, is a relatively stable block, with minor deformation, surrounded by active fold-thrust belts of accurate form (Talesh, Alborz, and Kopeh Dagh Mountains), which have undergone intense late Cainozoic crustal shortening. The basin is interpreted as a Neogene-Quarternary 'compressional depression', bounded by multi-role mountain-bordering reverse faults, and apparently floored by a late Palaeozoic-Triassic or late Mesozoic-early Tertiary 'modifed oceanic crust' trapped along an old geosuture. The author describes the detailed crustal structure of this area and discusses the tectonic history. (155 refs.)

73754 U-Pb geochronology of the Bokan Mountain peralkaline granite, southeastern Alaska. B.De Saint-Andre, J.R.Lancelot (Dept. des Sci. de la Terre, Univ. des Sci. et Tech. du Lanquedoc, Montpellier, France), B.Collot.
Can. J. Earth Sci. (Canada), vol.20, no.2, p.236-45 (Feb. 1983).
The Bokan Mountain arfvedsonite-aegirine granite is the only peralkaline acid intrusion actually known on the margin of the Canadian Cordillera. It is the end product of a peralkaline magmatic evolution and is characterized by genetically associated concentrations of U and Th. The U-Pb method on zircons has been used to date two samples: one from a barren peralkaline granite and one from a low-grade U-Th mineralized albitite. A typological study has revealed two genetically different populations of zircons in the barren granite. The upper intercept age of 171 ± 5 Ma obtained on a concordia diagram dates the emplacement of the peralkaline granite. A Jurassic period of magmatic activity must be integrated into the geological history of Prince of Wales Island. Peralkaline magmatism may have occurred when the Alexander Terrane rifted away from its more southerly area of origin. (37 refs.)

73755 Chronology of tectonothermal activity in the western Avalon Zone of the Newfoundland Appalachians. R.D.Dallmeyer (Dept. of Geology, Univ. of Georgia, Athens, GA, USA), E.M.Hussey, S.J.O'Brien, C.F.O'Driscoll.
Can. J. Earth Sci. (Canada), vol.20, no.3, p.355-63 (March 1983).
The Ackley granite was intruded into variably deformed and metamorphosed rocks within the Gander and Avalon Zones of the Newfoundland Appalachians. Biotite and hornblende from the pluton record internally concordant $^{40}Ar/^{39}Ar$ age spectra that define total-gas dates of 352-356 Ma. These indicate relatively rapid post-magmatic cooling, a feature consistent with the post-kinematic character of the pluton. In the western Avalon Zone, recrystallized, sericitic metavolcanic rocks from the Late Precambrian Love Cove and Marystown Groups display variably discordant, whole-rock $^{40}Ar/^{39}Ar$ age spectra. However, the samples yield well defined plateau ages of 353-400 Ma (11 samples), which are interpreted to closely date the regional metamorphism and associated deformation in the western Avalon Zone. This chronology is similar to that of the easternmost Gander Zone, indicating that deformation and metamorphism in the western Avalon Zone occurred simultaneously with tectonic juxtaposition of the Gander and Avalon terranes during the Acadian Orogeny. (52 refs.)

73756 Trace-element mobility during low-grade metamorphism and silicification of basaltic rocks from Saint John, New Brunswick. J.Dostal (Dept. of Geology, Saint Mary's Univ., Halifax, NS, Canada), D.F.Strong.
Can. J. Earth Sci. (Canada), vol.20, no.3, p.431-5 (March 1983).
Upper Carboniferous basaltic lavas from Saint John, New Brunswick were metamorphosed under prehnite-pumpellyite conditions and some were also affected by extensive silicification. Silicification led to simple dilution of relatively immobile elements such as rare earths, Y, Zr, Hf, Th, and Sc. The chrondrite-normalized REE patterns of the silicified rocks are parallel to those of basalts. (16 refs.)

73757 Landward flow in the upper mantle: effects of the heat sink and viscous coupling of the sinking slab. M.Rabinowicz, B.Lago, M.Souriau (GRGS/CNES, Toulouse, France).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.76-88 (April 1983).
Regional studies landward of a trench show that gravity anomalies are low compared with those expected from a cold sinking slab and that residual depth anomalies are strongly negative at distances up to 1200 km from the trench. It is shown that flow models taking simultaneously account of the viscous coupling and of the cooling effect of the sinking slab are able to explain these facts: the viscous coupling being related only to observed data down to 400 km from the trench, while the cooling effect mainly explains data at larger distances from the subduction zone. (25 refs.)

73758 Density inhomogeneities under island arcs systems. M.Ye.Artem'yev, V.N.Strakhov, M.I.Lapina, L.M.Tokar'.
Izv. Acad. Sci. USSR Phys. Solid Earth (USA), vol.18, no.1, p.1-17 (1982).
Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.1 (1982).
On the basis of data obtained from studies of deep seismic sounding type, models of the Earth's crust across the Kurile, Bonin, Mariana and Greater Antilles (Puerto Rico) island arcs are constructed. The calculated gravity effect of these models is eliminated from the observed gravity anomaly profiles. The residual anomalies obtained vary within the limits of ±250 mgal. Using a selection method, two fundamentally different density models obtained which satisfy the residual anomaly field with high accuracy. An attempt is made to solve the problem of choosing one of the two models by using a special combination of interpretation methods. The surface of the high

density mantle and the low density zone are discussed. The residual gravity anomalies are explained. (28 refs.)

73759 A geothermal model of the lithosphere and a map of the thickness of the lithosphere on the territory of the USSR. V.Cermak (Geophys. Inst., Acad. of Sci., Prague, Czechoslovakia).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.1, p.18-27 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.1 (1982).
A layered model of the Earth's crust and upper mantle is considered in which the vertical distribution of the thermal conductivity is given in accordance with experimental data for rocks as function of temperature. It is assumed that radiogenic heat generation in the crust decreases with depth according to an exponential law. In the mantle the radioactivity does not vary with depth: down to a depth of 120 km it corresponds to a dunite-peridotite composition, while below this it corresponds to pyrolyte. For this model generalized temperature curves are calculated for which the parameter is the heat flow on the surface. An interpretation of geothermal data enables one to determine the thickness of the lithosphere. The method is applied to the heat flow field on the territory of the USSR. A map of the regional distribution of the thickness of the lithosphere is constructed. (46 refs.)

73760 Finite amplitude tidal waves at the interface between two fluid saturated porous media. M.Venkatachalappa, R.Sekar, N.Rudraiah (Dept. of Math., Central Coll., Bangalore Univ., Bangalore, India).
Indian J. Pure & Appl. Math., vol.14, no.2, p.207-21 (Feb. 1983).
The propagation of finite amplitude tidal waves at the interface between two semi-infinite fluid saturated porous media of different densities with the external constraint of rotation is investigated using both analytical and numerical methods. The set of non-linear partial differential equations governing the wave motion have been reduced to the set of non-linear ordinary differential equations using a suitable integral. From this set, the phase portraits are obtained. The analytical results, obtained by neglecting the residue integral show that the periodic tidal waves exist in the case of a fluid saturated porous medium only for small values of porous parameter. When the governing non-linear wave equations are integrated directly, the authors found that the tidal waves are almost periodic for small values of porous parameter. The important conclusions are: (i) The Coriolis force has a significant effect on wavelength which is useful in the study of abnormality in the interior of the Earth. (ii) The effect of porous parameter in the presence of rotation is to make the waves periodic only for small values of porous parameter and its effect is to reduce the amplitude of the waves, due to the dampening effect of Darcy's resistance. (11 refs.)

73761 A kinematic thermal history of the Earth's mantle. R.T.Langan (Dept. of Geological Sci., Northwestern Univ., Evanston, IL, USA), N.H.Sleep.
J. Geophys. Res. (USA), vol.87, no.B11, p.9225-35 (10 Nov. 1982). [received: May 1983]
Kinematic convection models of the Earth's thermal history are computed assuming that subducted slabs, along with some entrained material, sink all the way to the core-mantle boundary. The temperatures within the lithosphere and within the mantle away from sinking slabs are computed assuming that the return flow from the core-mantle boundary to the surface can be considered as slow, vertical advection. In the models, a drop in asthenospheric temperature occurs near the end of the Archean when subducted material first returns to the surface. This drop is about 200°C if the subducted material does not mix thermally with the mantle on its way down and if only a thin thermal layer exists at the core-mantle boundary. The possibility that this temperature drop is an explanation for the transition between Archean and Proterozoic tectonic styles is considered. An implication of the kinematic scheme is that the asthenospheric temperature increases gradually during the Archean until the cooler material reaches the surface. After the Archean, the thermal evolution is similar to a well-mixed model. (57 refs.)

73762 Permafrost, heat flow, and the geothermal regime at Prudhoe Bay, Alaska. A.H.Lachenbruch, J.H.Sass, B.V.Marshall, T.H.Moses,Jr. (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9301-16 (10 Nov. 1982). [received: May 1983]
Temperature measurements through permafrost in the oil field at Prudhoe Bay, Alaska, combined with laboratory measurements of the thermal conductivity of drill cuttings permit an evaluation of in situ thermal properties and an understanding of the general factors that control the geothermal regime. A sharp contrast in temperature gradient at $\sim$600 m represents a contrast in thermal conductivity caused by the downward change from interstitial ice to interstitial water at the base of permafrost under near steady state conditions. Interpretation of the gradient contrast in terms of a simple model for the conductivity of an aggregate yields the mean ice content ($\sim$39%), and thermal conductivities for the frozen and thawed sections. These results yield a heat flow of $\sim$1.3 HFU, the anomalously deep permafrost is a result of the anomalously high conductivity of the siliceous ice-rich sediments. Curvature in the upper 160 m of the temperature profiles represents a warming of $\sim$1.8°c of the mean surface temperature and a net accumulation of 5-6 kcal/cm^2 by the solid Earth surface during the last 100 years or so. Rising sea level and thawing of ice-rich sea cliffs probably caused the shoreline to retreat tens of kilometers in the last 20000 years, inundating a portion of the continental shelf that is presently the target of intensive oil exploration. (40 refs.)

73763 Structure and origin of the J Anomaly Ridge, western North Atlantic Ocean. B.E.Tucholke (Woods Hole Oceanographic Instn., Woods Hole, MA, USA), W.J.Ludwig.
J. Geophys. Res. (USA), vol.87, no.B11, p.9389-407 (10 Nov. 1982). [received: May 1983]
The J Anomaly Ridge is a structural ridge or step in oceanic basement that extends southwest from the eastern end of the Grand Banks. It lies beneath the J magnetic anomaly at the young end (M-4 to M-0) of the M series magnetic anomalies. Its structural counterpart beneath the J anomaly in the eastern Atlantic is the Madeira-Tore Rise, but this feature has been overprinted by post-middle Cretaceous deformation and volcanism. In order to study the tectonic origin and evolution of the J Anomaly Ridge-Madeira-Tore Rise system, the authors obtained seismic refraction and multichannel reflection profiles across the J Anomaly Ridge near 39°N latitude. (63 refs.)

73764 Pb-Sr isotope variation in Indian Ocean basalts and mixing phenomena. B.Dupre, C.J.Allegre (Dept. des Sci. de la Terre, Univ. Pierre et Marie Curie, Paris, France).
Nature (GB), vol.303, no.5913, p.142-6 (12 May 1983).
Pb and Sr isotopic compositions from the Indian Ocean (active ridges, old ocean floor, and seismic ridge samples) confirm the characteristic nature of the mantle record in this region. The results emphasize the importance of mixing processes between the lower mantle (oceanic-island basalt source), and the upper mantle (ridge-basalt source). The isotopic characteristics of the Indian Ocean islands seem to be in agreement with the hypothesis of the reinjection of sediments into the mantle. (32 refs.)

73765 Hot springs on the ocean floor. J.M.Edmond, K.Von Damm.
Sci. Am. (USA), vol.248, no.4, p.70-85 (April 1983).
A sign of the volcanic activity that mints new oceanic crust, they nourish strange forms of life and lay down great deposits of ore. They also help to explain the chemical content of the sea. (no refs.)

73766 A global geochemical model for the evolution of the mantle. D.L.Anderson (Seismological Lab., California Inst. of Technol., Pasadena, CA, USA).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.6-18. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
A geochemical model of the mantle is presented which incorporates different compositions above and below the 670 km seismic discontinuity. The upper mantle transition region is assumed to be eclogite or olivine eclogite. The rest of the upper mantle is assumed to be garnet peridotite or pyrotite. Mantle convection patterns and early differentiation are computed using these assumptions. In this model plate tectonics is intermittent. At a depth of 150-220 km the continental thermal anomaly triggers kimberlite and carbonatite activity, alkali and flood basalt volcanism, vertical tectonics and continental breakup. Hotspots remain active after the continents leave, building the oceanic islands. Mantle plumes rise from a depth of about 220 km. Midocean ridge basalts originate in the depleted layer below this depth. Material from this layer may also be displaced by subducted oceanic lithosphere to form back-arc basin magmas. (60 refs.)

73767 Temperature profiles in the Earth. O.L.Anderson (Dept. of Earth & Space Sci., Univ. of California, Los Angeles, CA, USA).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.19-27. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
A geotherm from 80 to 5153 km depth is proposed. The temperature gradient in the upper mantle is found by using laboratory data on minerals in conjunction with seismic travel-time curves. The temperature at the beginning of the transition zone, 380 km, is taken to be 1400°C, following the results of the phase transitions in olivine. The lower mantle temperature gradient is found by assuming adiabatic compression and taking γ to be γ_a (gamma acoustic). A small correction is made for the effect of apparent superadiabaticity (100°) throughout the lower mantle. The temperature gradient of the outer core is found by assuming adiabatic compression and by taking T to be constant (γ=1.4). An estimate for the ΔT jump at thermal barriers at 670 km and 2885 km depth is needed. The result gives 4080K at the inner-outer core boundary. The results are compared with several current thermal models of the Earth. (32 refs.)

73768 Deep crustal structure: implications for continental evolution. L.D.Brown, J.E.Oliver, S.Kaufman, J.A.Brewer, F.A.Cook, F.S.Schilt, D.S.Albaugh, G.H.Long (Dept. of Geological Sci., Cornell Univ., Ithaca, NY, USA).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.38-52. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Current concepts of the deep crust beneath the continents as compositionally heterogeneous and structurally complex represent a major refinement of earlier approximations of crustal structure as relatively simple two or three layer sequences of 'granitic' over 'gabbroic' rock. The increased recognition of the complexity of deep crustal structure has resulted in large part from the use of advanced seismic sounding methods. The authors describe how deep seismic reflection and refraction studies such as COCORP have contributed to the present knowledge of deep crustal geology. The early phases of continental evolution studied by these methods include extensional tectonics, transform faulting, compressional tectonics and plate boundary areas. (67 refs.)

73769 Mineral deposits as guides to supracrustal evolution. R.W.Hutchinson (Dept. of Geology, Univ. of Western Ontario, London, Ontario, Canada).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.120-40. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Evolutionary changes in major types of mineral deposits from Archean to Recent time provide guides to the main events and sequence of Earth's supracrustal tectonic evolution and related processes. Evolutionary changes through time in ferruginous sedimentary rocks reflect a changing source of iron through geologic time and also oxygenation of the oceans about 2.2 b.y. ago. Differences between nickel deposits in Archean, Proterozoic and Phanerozoic rocks may be due to evolutionary changes in crust-mantle thickness and mantle composition. Other types of mineral deposits studied include lode gold deposits, massive base-metal sulphide deposits and uranium deposits. The Archean greenstone belt was studied. The supracrustal sequences took place under reducing conditions. The relevance of past continental mass distribution and plate tectonics is also studied. (114 refs.)

73770 On the mechanism of the gravitational differentiation in the inner Earth. V.P.Keondjan (P.P. Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.167-95. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
The gravitational differentiation of the Earth's interior leads to the formation of the Earth's core. Qualitative consideration shows the possibility of gravitational instability due to separation of matter within the layers of the core-mantle boundary. The result of such an unstable process is convective motion in the body of the mantle. This process is connected with density inversion of nonthermal origin. Construction of a mathematical model of this phenomenon based on multicomponent fluid dynamics is a necessity. Such a model is described. (21 refs.)

73771 The role of oxidation-reduction reactions in the Earth's early history. O.L.Kuskov (Vernadsky Inst. of Geochem. & Analytical Chem., Acad. of Sci., Moscow, USSR).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.196-209. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Thermodynamical analysis of oxidation-reduction reactions for the undifferentiated Earth in the early stage of its evolution has been carried out. The possibility of reduction of ferromagnesian silicates, magnesiowustite, magnetite, and stishovite by carbon in the closed and in the open systems at very high pressures has been considered. It is shown that the processes of reduction in the closed system are thermodynamically forbidden. Calculations of thermal effects of oxidation-reduction reactions in the open systems have been carried out. The results of calculations show that a change in sign of the thermal effect occurs in the open system at a certain critical pressure on the solid phases. Calculations of ΔH for several reactions which are important for the thermal history of the Earth are presented at pressures up to 2 Mbar and the change in temperature for the undifferentiated Earth are estimated. The

data show that the central part of the Earth and the deep interior could become warm due to reduction processes. The reducing conditions in the early history of the Earth during the core formation imply that a large fraction of chemical reaction heat was released in the central part of the Earth. (45 refs.)

73772 **Terrestrial heat flow history and temperature profiles.** E.A.Lubimova, O.Parphenuk (Inst. of Phys. of Earth, Moscow, USSR).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.217-28. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Discusses the global patterns amd magnitude of heat flow through the crust. Using this information the thermal history of the Earth is studied. An empirical exponential negative relationship between crustal heat flow and the latest geotectonic event exists for oceanic and continental lithospheres with simple structure. On this basis heat flow observations may give information on (i) an energy pulse due to core-mantle segregation, (ii) large astronomical body impacts on the early Earth, (iii) mantle convection. These problems are studied in this article by use of a numerical model. Earth interior geotherms are produced. (65 refs.)

Evolution of the Earth .... See Entry 69784

Tectonic and geologic evolution of southeast asian seas and islands. Pt.2 .... See Entry 69796

Global isostatic geoid anomalies for plate and boundary layer models of the lithosphere .... See Entry 73706

Paleomagnetism of diabase dikes from the Bonavista bay area of northeastern central Newfoundland .... See Entry 73710

Paleomagnetism of the Borden dykes of Baffin Island and its bearing on the Grenville Loop .... See Entry 73712

Electrical conductivity of the Earth's crust and the upper mantle in Kamchatka, based on data from magnetotelluric logging .... See Entry 73718

Hydromagnetic waves in a differentially rotating sphere .... See Entry 73720

The stabilizing role of differential rotation on hydromagnetic waves .... See Entry 73721

Magnetometer arrays and geodynamics .... See Entry 73722

Seismicity induced by surface mining: the Belchatow, Poland, earthquake of 29 November 1980 .... See Entry 73723

Interaction of shear cracks in an external stress field .... See Entry 73726

The effect of attenuation on seismic body waves .... See Entry 73732

The structure, density, and homogeneity of the Earth's core .... See Entry 73749

Analysis of states of stress between provinces of constant stress .... See Entry 73775

Radiogenic isotopes and crustal evolution .... See Entry 73778

Intraplate stress orientations from Alberta oil-wells .... See Entry 73779

Marine geology of the Hess Rise. II. Basement morphology, sediment thickness, and structural geology .... See Entry 73785

Acoustic backscattering from the basin and margins of the Arctic Ocean .... See Entry 73786

Stress magnitudes in natural rock salt .... See Entry 73790

Discovery of striated calcareous concretions in the Gentilly Till of Saint Laurent, Quebec .... See Entry 73797

Theory of the development of geothermal systems charged by vertical faults .... See Entry 73846

On fluid reserves and the production of superheated steam from fractured, vapor-dominated geothermal reservoirs .... See Entry 73847

Isotopic composition of the ocean-atmospheric system in the geologic past .... See Entry 73916

Fission track dating of kimberlitic zircons .... See Entry 73934

Determination of the coefficients of absorption and scattering by a combined analysis of regular waves and coda .... See Entry 73936

An assessment of ^{40}Ar-^{39}Ar dating of incompletely degassed xenoliths .... See Entry 73940

91.40 VOLCANOLOGY

Hot springs on the ocean floor .... See Entry 73765

El Chichon and Britain's weather .... See Entry 73910

91.45 PHYSICS OF PLATE TECTONICS

73773 **The Jurassic Basin in the Maritime Alps (France): palaeogeography, tectonic control and later deformations.** G.Dardeau (Univ. de Nice, Nice, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.8, p.661-4 (28 Feb. 1983). In French.
During the Jurassic, the Maritime Alps basin was settled in a peculiar location, i.e. where the 'Brianconnais', 'Dauphinois' and 'Provencal' realms merged together. In its geological history the main episodes preceding and accompanying the oceanic opening of the Ligurian branch of the Tethys can be found: rifting, then downwarping and deepening of the continental margins which are expressed by two successive sedimentary patterns. The palaeogeographic trends are characterized by the occurrence, southwards, of a smoothly uneven land surface—the Corsico-Sardinian block—along which deposit areas narrow near the 'Brianconnais' domain. Subsequent tectonic deformations follow the same pattern, already defined during the Jurassic, with small-side displacements. (12 refs.)

73774 **Paleomagnetic constraints on the Late Cretaceous and Cenozoic tectonics of southeastern Asia.** J.Achache, V.Courtillot, J.Besse (Inst. due Phys. du Globe, UER de Sci. Phys. de la Terre, Paris, France).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.123-36 (April 1983).
Reviews the relevant paleomagnetic data for the Late Mesozoic and Cenozoic and compares them with the predictions of the 'propagating extrusion tectonics' model and, more generally, to put constraints on future tectonic models of the area. (44 refs.)

73775 **Analysis of states of stress between provinces of constant stress.** A.McGarr (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9279-88 (10 Nov. 1982). [received: May 1983]
Recent studies have indicated the existence of crustal provinces or domains within which the state of stress shows little apparent horizontal variation. Between provinces the state of stress may undergo substantial changes, often over remarkably short distances. As analyzed here, the transition in stress state between adjacent domains is caused by shear tractions acting on the base of the elastic-brittle layer and is mediated by a stress field within a zone between the provinces that can be determined by solving the equations of force equilibrium and stress compatibility. The component of horizontal stress oriented perpendicular to the provincial boundary changes smoothly across the transition zone from one province to the other, whereas the horizontal stress oriented parallel to the boundary shows smaller but discontinuous changes. The horizontal component of shear stress is unlikely to change from one province to another because of the implausible nature of the required basal traction; thus, in this regard, states of stress in adjacent domains appear to be coupled. The coincidence of a number of stress transition zones with boundaries defined by heat flow suggests that in many cases the basal tractions are the result of thermally induced mass transport below the elastic-brittle layer in the direction of increasing horizontal compressive stress. (41 refs.)

73776 **Recomputation of vertical crustal motions near Palmdale, California, 1959-1975.** S.R.Holdahl (Nat. Geodetic Survey, Nat. Ocean Survey, Rockville, MD, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9374-88 (10 Nov. 1982). [received: May 1983]
Vertical motion in the Palmdale region has been reassessed by simultaneous least squares adjustment of the networks formed by the corrected observations. The new results show 7.5±4.0 cm of apparent upward movement at Palmdale. Part or all of the 7.5 cm might be attributable to residual systematic error. The great concern associated with Palmdale, if based on motion calculated from leveling data, does not seem warranted. Castle's (1976) original result was strongly influenced by a single level route to Palmdale. Refraction error accumulates rapidly on this route because of the long gentle slope and the location of sightings over railroad ballast where vertical temperature gradients are unusually large. (18 refs.)

73777 **Tectonic influences on sedimentation, Early Cretaceous, East Flank Powder River Basin, Wyoming and South Dakota.** R.J.Weimer (Colorado School of Mines, Golden, CO, USA), J.J.Emme, C.L.Farmer, L.O.Anna, T.L.Davis, R.L.Kidney.
Q. Colorado Sch. Mines (USA), vol.77, no.4, p.1-61 (Oct. 1982). [received: April 1983]
Recurrent movement of basement fault blocks in the east-central Powder River Basin has controlled thickness variations and the distribution of porous and permeable reservoir sandstone within Lower Cretaceous strata. A depositional model, incorporating tectonic and sea level adjustments, illustrates that both marine and nonmarine units thicken in structurally low (graben) areas and thin over structural high (horst) areas. (37 refs.)

73778 **Radiogenic isotopes and crustal evolution.** D.J.DePaolo (Dept. of Earth & Space Sci., Univ. of California, Los Angeles, CA, USA).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.59-68. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Recent studies of the geochemical evolution of the continent crust using radiogenic isotopes of Sr, Nd and Pb have clarified many aspects of the origin and history of the crust. The times of formation of crustal rocks from the mantle can be determined with relative ease using Nd isotopes, which should allow a more accurate description of the age and growth history of the continents to be constructed. Comparison with the Moon suggests that the absence of congenital crust on the Earth is due either to efficient recycling of the crust during the first billion years or to a cataclysmic destruction of the crust about 3.8-4.0 AE ago. The formation of new crust has involved a considerable amount of reconstitution of preexisting crust in the Phanerozoic, but in contrast, Archean crust appears to have been almost purely mantle-derived. There is increasing evidence of gross chemical layering in the crust which forms within a few hundred million years after the formation of new crust from the mantle. Other aspects of isotope geochemistry and the history of the crust are considered. (43 refs.)

73779 **Intraplate stress orientations from Alberta oil-wells.** J.S.Bell, D.I.Gough (BP Canada Ltd., Calgary, Alberta, Canada).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.96-104. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Many oil-wells in Alberta are noncircular as a result of spalling of their walls. Such break-outs occur over a wide depth range covering the stratigraphic column from Devonian through Cretaceous. The azimuths of greatest elongations are given by modern four-arm dipmeter logs, and are tightly grouped in a northwest-southeast direction. They are unrelated to dip of the strata. The observed break-out orientations would require the larger horizontal principal stress to be directed northeast-southwest, normal to the Rocky Mountains fold axes. As a normal stress field (σ_1 vertical) would give horizontal stresses too small to produce break-outs at depth of a few hundred metres, it is believed that σ_1 is horizontal and NE-SW. In the present paper, new break-out orientation data are added, and hydraulic fracturing data are examined. The possible causes for the observed stress field are considered. (23 refs.)

73780 **Plate tectonic patterns and convection in the Phanerozoic.** E.R.Kanasewich, M.E.Evans, J.Havskov (Dept. of Phys., Univ. of Alberta, Edmonton, Canada).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.147-66. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Paleomagnetic observations, oceanic magnetic lineations, and the present continental margins are combined in an interactive computer program to generate maps for seven periods in the Phanerozoic Era. By using geological evidence on the position of geosynclines, volcanic assemblages, and zones of diastrophism an attempt is made to model a reconstruction of major plate boundaries in the past. During the Cambrian and Ordovician. Periods the continental segments were as widely dispersed as at present and formed a ring of plates on the paleoequator. In these, as in other periods, there is symmetry about the spin axis. Extensive plate motion occurred at about the time of the Caledonian Orogeny. Toward the end of the Cretaceous Period a more dispersed form began to develop yielding the present pattern. The mantle convection patterns throughout this time are discussed. (75 refs.)

73781 **Surface plates and thermal plumes: separate scales of the mantle convective circulation.** W.R.Peltier (Dept. of Phys., Univ. of Toronto, Toronto, Canada).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.229-48. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
The whole mantle convection hypothesis follows naturally from the inference using post-glacial rebound data that there is no dramatic increase of viscosity with depth in the mantle. If convection fills the entire mantle then those properties of the circulation which are accessible to direct measurement are easily explicable in terms of the same scaling laws which govern high Rayleigh and Prandtl number convection in the laboratory. The viscosity con-

trasts which exist across the thermal boundary layers appear to exert no active influence on the flow, apart from stabilizing the top boundary layer (lithosphere) against secondary convective instability and destabilizing the bottom boundary layer adjacent to the core-mantle interface. Destabilization of the bottom boundary layer, which is observed using seismic methods as the D″ region, may lead to the formation of thermal plumes which rise so rapidly to the base of the lithosphere that their ascent is almost adiabatic. Temperature dependent viscosity therefore leads to the observed style of mantle convection which is dominated by two widely separated spatial scales associated respectively with surface plates and thermal plumes. (54 refs.)

Evolution of the Earth .... See Entry 69784

Tectonic and geologic evolution of southeast asian seas and islands. Pt.2 .... See Entry 69796

Paleomagnetism of the Borden dykes of Baffin Island and its bearing on the Grenville Loop .... See Entry 73712

Paleomagnetism of Archean volcanics and Proterozoic dikes in La Grande Riviere area of Nouveau-Quebec .... See Entry 73714

A magnetic profile and inferred seafloor spreading in Foul Bay, Red Sea .... See Entry 73716

Seismicity induced by surface mining: the Belchatow, Poland, earthquake of 29 November 1980 .... See Entry 73723

Interaction of shear cracks in an external stress field .... See Entry 73726

Some aspects of tectonic history of the Holy Cross Mountains in the light of palaeomagnetic studies .... See Entry 73751

Tectonic significance of Cameron's Line in the vicinity of the Hodges Complex—an imbricate thrust model for western Connecticut .... See Entry 73752

The southern Caspian: a compressional depression floored by a trapped, modified oceanic crust .... See Entry 73753

Chronology of tectonothermal activity in the western Avalon Zone of the Newfoundland Appalachians .... See Entry 73755

Landward flow in the upper mantle: effects of the heat sink and viscous coupling of the sinking slab .... See Entry 73757

Density inhomogeneities under island arcs systems .... See Entry 73758

A kinematic thermal history of the Earth's mantle .... See Entry 73761

Structure and origin of the J Anomaly Ridge, western North Atlantic Ocean .... See Entry 73763

Pb-Sr isotope variation in Indian Ocean basalts and mixing phenomena .... See Entry 73764

A global geochemical model for the evolution of the mantle ... See Entry 73766

On the mechanism of the gravitational differentiation in the inner Earth .... See Entry 73770

Marine geology of the Hess Rise. II. Basement morphology, sediment thickness, and structural geology .... See Entry 73785

Sedimentology of Upper Ordovician—Silurian sequences on New World Island, Newfoundland: separate fault-controlled basins? .... See Entry 73794

91.50 MARINE GEOLOGY AND GEOPHYSICS

73782 **Hudson Bay river sediments and regional glaciation. II. Comparison of carbonate mineralogy of size fractions for ice movement inference.** J.D.Adshead (Terrain Sci. Div., Geological Survey of Canada, Ottawa, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.305-12 (Feb. 1983).
For pt.I see ibid., vol.20, no.2, p.290-304 (1983). The application of stream sediment data to problems of local or regional mineralization in glaciated areas requires knowledge of the compositional modifications that accompany the transition from bedrock to glacial drift and from drift to fluvial sediment. Differential abrasion of mineral constituents plays an important role in altering the source rock composition at all stages during this transition. To study the effects of differential abrasion on fluvial sediments in the Hudson Bay area, the mineralogy of the silt and clay fractions of river muds from the west side of Hudson and James Bays is compared with the mineralogy of river sands (Adshead 1983) from the same area. (14 refs.)

73783 **A multitracer approach to the study of erosion in the northeast equatorial Pacific.** D.Kadko (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.13-33 (April 1983).
Erosion of sediment at two sites within the siliceous-clay province of the northeast equatorial Pacific is investigated by examining radionuclide, radiolarian and percent smectite profiles of three box cores. A numerical box model of the sediment is presented that examines the effect of various particle rain rates, erosion rates and biological mixing parameters on these profiles. (38 refs.)

73784 **Hydrothermal manganese oxide deposits from Galapagos mounds, DSDP Leg 70, hole 509B and 'Alvin' dives 729 and 721.** C.Lalou, E.Brichet, C.Jehanno, H.Perez-Leclaire (Centre des Faibles Radioactivites, CNRS/CEA, Gif-sur-Yvette, France).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.63-75 (April 1983).
During DSDP Leg 70, a 1.60 m thick manganese oxide layer was sampled in hole 509B. This deposit is formed of alternating layers of hard plates of pure todorokite, about 2 mm thick, and of a more powdery material deeply impregnated with manganese oxide, about 3 mm thick. A SEM study of the plates and the associated powder shows that the powdery material is a transformation of a pre-existing sediment, while the plates are a direct precipitation from a hydrothermal solution. The uranium series disequilibrium method was used to determine the ages of the plates. They are found to be in good chronological sequence and in accordance with the sedimentation rate of the area (4.9 cm/10^3 years) which implies that they have been formed at the sediment-seawater interface during a pulsed injection of hydrothermal solution. The powder presents systematically an 'older age' which is explained by a slowing down of the injection while the normal sediment settles; the older age is due to the ^{230}Th excess of the sediment. (30 refs.)

73785 **Marine geology of the Hess Rise. II. Basement morphology, sediment thickness, and structural geology.** L.W.Kroenke, K.Nemoto (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9259-78 (10 Nov. 1982). [received: May 1983]
For pt.I see ibid., vol.86, no.B11, p.10734-52 (1981). The basement morphology and sediment thickness of the Hess Rise, an oceanic plateau in the central North Pacific, have been mapped on the basis of seismic reflection profiles. The acoustic stratigraphy on and around the rise is correlated with the lithostratigraphy at Deep Sea Drilling Project sites 464, 310, 465, and 466. A total sediment isopach chart of the rise reveals small-scale departures from the expected sedimentary pattern (thick sediment in shallow areas; thin sediment in deep areas). Sediment-filled basement depressions result from mass transport. A pre Senonian sediment isopach chart shows a thickening from less than 50 m to more than 250 m of sediment from the northeast to the southwest. This trend seems explainable only in terms of the time-transgressive nature of seafloor formed at a mid-ocean ridge. The axial trend of the rise (N30°W) parallels nearby Mesozoic magnetic lineations and seems to be isochronous as deduced from the Deep Sea Drilling Project data. The Hess Rise began developing in late Aptian time along a segment of the Pacific-Farallon Ridge. Important events in the history of the rise include late-stage volcanism on the southern margin of the rise along the Mendocino Fracture Zone, tectonism and volcanism about 85 Ma that resulted in a major regional nonconformity (reflector C). (56 refs.)

73786 **Acoustic backscattering from the basin and margins of the Arctic Ocean.** I.Dyer, A.B.Baggeroer, J.D.Zittel, R.J.Williams (Dept. of Ocean Engng., MIT, Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9477-88 (20 Nov. 1982). [received: May 1983]
Sound waves created by high-energy explosives were used to measure reverberation and backscattering in the Arctic Ocean. From an ice camp in the Beaufort Sea, signals were backscattered from the continental margin and other major features of the basin. An acoustic array was used to analyse the signals in azimuth. Based on these data the authors constructed charts of normalised backscatter level, which can be compared with known topography of the Arctic Ocean. The resolution of this technique is about 8° in azimuth, 15 km in radial extent, and 1 km in depth. Interpretable signals were obtained out to 2700 km. For 1000 km or less, the backscatter charts provide continuous coverage of the margins and major submerged features. Strong returns from about 73.2°N, 139.0°W indicate one or more prominent features that many contemporary topographic charts do not show. Other strong returns are evident from the Northwind Escarpment and from the continental slopes of Alaska and the Canadian Archipelago. (39 refs.)

73787 **Settling velocity distribution of natural aggregates.** N.Hawley (Dept. of Atmospheric & Oceanic Sci., Univ. of Michigan, Ann Arbor, MI, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9489-98 (20 Nov. 1982). [received: May 1983]
An analysis of previous experimental determinations of aggregate settling rates for particles <100 μm in diameter shows that these particles fall significantly more quickly than Stokes' law predicts, with the deviations being most pronounced for smaller particles. This implies that previous sediment flux calculations which have used a form of Stokes' law to obtain aggregate velocities may have significantly underestimated the contribution from the smaller aggregates. The measured fall velocity distributions are described as the sum of normally distributed populations (four for the lacustrine data, two for the marine) whose means, standard deviations and weights have been determined. Because of the increased settling velocities and the use of a distribution of velocities for a given particle size, collisions due to differential settling rates are the governing nonbiological process in the formation of natural aggregates. (26 refs.)

The geochemistry of plutonium in fresh and marine water environments .... See Entry 73488

Mapping the Miocene Farallon Ridge jump on the Pacific plate: a seismic line of weakness .... See Entry 73742

Pb-Sr isotope variation in Indian Ocean basalts and mixing phenomena .... See Entry 73764

Hot springs on the ocean floor .... See Entry 73765

Depositional environments along a carbonate ramp to slope transition in the Silurian of Washington Land, North Greenland .... See Entry 73796

Evolution of liquid and solid discharges of a sub-boreal estuary: St. Jean river, Quebec (north coast of Gulf of St. Lawrence) .... See Entry 73803

Acoustic ocean with a propagation in the poro-elastic bottom .... See Entry 73811

Modeling ocean-bottom reflection loss measurements with the plane-wave reflection coefficient .... See Entry 73813

Energy saturation and phase speeds measured on a natural beach .... See Entry 73817

An analysis of the optical features of the near bottom and bottom nepheloid layers in the area of the Scotian Rise .... See Entry 73821

Evidence of pre-late Wisconsinan glaciations on Labrador Shelf—Cartwright Saddle region .... See Entry 73842

Hudson Bay river sediments and regional glaciation. I. Iron and carbonate dispersal trains southwest of Hudson and James Bays .... See Entry 73843

Hudson Bay river sediments and regional glaciation. III. Implications of mineralogical studies for Wisconsinan and earlier ice-flow patterns .... See Entry 73844

91.60 PHYSICAL PROPERTIES OF ROCKS AND MINERALS

73788 **Discrete single-domain and pseudo-single-domain titanomagnetite particles in silicic glass of an ash-flow tuff.** J.W.Geissman, N.G.Newberry, D.R.Peacor (Dept. of Geological Sci., Univ. of Michigan, Ann Arbor, MI, USA).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.334-8 (Feb. 1983).
Single-domain and pseudo-single-domain titanium-poor magnetite grains are present in silicic vitrophyre glass of an ash-flow tuff from western Nevada. Conventional transmission electron microscopy and analytical electron microscopy corroborate inferences, made solely from rock magnetic and remanence data, that the thermoremanent magnetization in the vitrophyre is carried by such grains. The magnetite grains vary in size, shape, and distribution throughout the glass. They probably crystallized during violent eruption and welding of the ash flow, at temperatures well in excess of 600°C. (25 refs.)

73789 **Equilibrium conditions at phase boundaries between elastic bodies.** M.A.Grinfel'd (A.Yu. Schmidt Earth Phys. Inst., Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.1, p.28-33 (1982).
Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.1 (1982).
The conditions of heterogeneous equilibrium of elastic (liquid, solid, gaseous) phases are studied with the aid of the Gibbs' (1950) principle. Two types of interfacial boundaries are distinguished: coherent boundaries and slip boundaries. The former serve to model a contact between solid elastic phases. The latter model interfacial boundaries, when one of the phases is a liquid or a gas. (20 refs.)

73790 Stress magnitudes in natural rock salt. N.L.Carter, F.D.Hansen, P.E.Senseny (RE/SPEC Inc., Rapid City, SD, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9289-300 (10 Nov. 1982). [received: May 1983]
Subgrain sizes have been determined for Avery Island domal salt that was deformed experimentally at pressures in the range 3.4 to 20.7 MPa, temperatures from 100° to 200°C, and constant mean principal stress differences of from 2.0 to 20.3 MPa. The subgrain size decreases systematically with increasing stress, independent of temperature, according to the relation $d=190\ \sigma^{-1}$, which is in substantial agreement with the work of others on single crystals and polycrystals of synthetic rocksalt. For two-stage creep experiments it is observed that while subgrain size decreases upon increasing the stress, it does not increase upon lowering the stress. Thus the stresses deduced for seven naturally deformed bedded, domal, and anticlinal rocksalts, 0.5-1.1 MPa, reflect maximum stress differences experienced. The results are applied briefly to considerations of steady state flow during the growth of salt diapirs. (43 refs.)

73791 Elastic moduli, thermal expansion, and inferred permeability of two granites to 350°C and 55 megapascals. H.C.Heard, L.Page (Geosci. Div., Lawrence Livermore Nat. Lab., Livermore, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9340-8 (10 Nov. 1982). [received: May 1983]
The coefficient of thermal linear expansion α, Young's modulus E, and bulk modulus K have been determined for the Westerly and Stripa granites to temperatures T of 350°C and pressures P to 55 MPa. Using conventional triaxial apparatus, displacement measurements were made on three samples from each of three orthogonal directions for both rocks. Comparison of the directional values at any P, T, and those from the nine-sample population indicated that within experimental precision, both granites are isotropic in E, K, and α. Both E and K for both rocks decreased with T and increased with P in nonlinear fashion. From 19° to 350°C, E decreased by as much as a factor of 2 and K decreased by 2 to 3 times, depending on P. From 6 to 55 MPa, E increased by factors of 3 to 6 and K increased by 3 to 5, depending on T. Values for α were neither constant nor a monotonic function of P or T. (41 refs.)

73792 Elasticity of pyroxenes: effects of composition versus crystal structure. D.J.Weidner (Dept. of Earth & Space Sci., State Univ. of New York, Stony Brook, NY, USA), M.T.Vaughan.
J. Geophys. Res. (USA), vol.87, no.B11, p.9349-53 (10 Nov. 1982). [received: May 1983]
The variation of elastic moduli among five pyroxenes exhibiting three crystal structures is generally small. The variations that do exist are related to structural differences. C_{11} is most sensitive to compositional changes on the basis of a mechanical structural analog. Its small variation among these pyroxenes suggests that the compositional range reflected by these samples (enstatite, bronzite, diopside) does not affect the elastic moduli. C_{33} is most sensitive to structural perturbations. The large variation of C_{33} (20%) implies that the small variations in crystal structure dominate the variations in elastic moduli. (16 refs.)

73793 Gem materials, natural and artificial. I.Sunagawa (Inst. of Mineralogy, Petrology & Economic Geology, Tohoku Univ., Sendai, Japan).
In book: *Current topics in materials science. Vol.10*, E.Kaldis [Ed.], p.353-497. Amsterdam, Netherlands: North-Holland (1982), vi+515 pp. [0 444 86321 4]
The author summarises the present understanding of gem materials, both natural and laboratory-produced. A comparison is made to see how they are similar or dissimilar in their properties, and to understand why physical properties of the same species can be different between natural and artificially produced gem materials. (137 refs.)

Thermal aspects of radioactive waste burial in hard rock ....See Entry 70651

Effects of ionizing radiation during the disposal of radioactive wastes into geological formations ....See Entry 70657

The study of the interaction of the components of imitator-glasses of glassified radioactive wastes with various surrounding rocks ....See Entry 70698

Paleomagnetism of diabase dikes from the Bonavista bay area of northeastern central Newfoundland ....See Entry 73710

Magnetic inclination of basaltic rocks from the East-Pacific Rise at 21 degrees North and validity of polarity criteria ....See Entry 73713

The determination of the internal magnetic field in magnetic grains ....See Entry 73941

91.65 GEOPHYSICAL ASPECTS OF GEOLOGY, MINERALOGY AND PETROLOGY

73794 Sedimentology of Upper Ordovician—Silurian sequences on New World Island, Newfoundland: separate fault-controlled basins?. R.J.Arnott (Dept. of Geology & Mineralogy, Oxford Univ., Oxford, England).
Can. J. Earth Sci. (Canada), vol.20, no.3, p.345-54 (March 1983).
Remapping of northeast New World Island, Newfoundland demonstrates that two major faults separate three distinct sedimentary sequences. Paleontology and sedimentology indicate that these sequences are partly equivalent in age but were deposited in separate basins of deposition that were adjacent to each other. The author describes the stratigraphy, sedimentology, and structure of these sequences and shows how faulting throughout the Early Silurian (Llandovery) influenced sedimentation by uplifting blocks of Caradoc and older rocks between distinct Llandovery troughs. (18 refs.)

73795 Morphometry of open rock basins, Kananaskis area, Canadian Rocky Mountains. D.J.Sauchyn, J.S.Gardner (Dept. of Geography, Univ. of Waterloo, Waterloo, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.3, p.409-19 (March 1983).
Digital elevation data have been obtained for 54 open rock basins from aerial diapositives using an analytical stereoplotter. The term 'open rock basin' is used to distinguish these basins from the closed rock basins of classical glacial cirques. The morphometric analyses are based on nine indices: length, width, area, relief, length/width, length/relief, width/relief, area/relief, and compactness. Cluster analysis of compactness and area/relief data indicates five distinct clusters of open rock basins, which are attributed to variations in topoclimate and geologic structure. The three largest clusters are labelled rockfall chutes, rockfall funnels, and open cirques. The cirque cluster is compared with glacial cirques for which published morphometric data exist. (26 refs.)

73796 Depositional environments along a carbonate ramp to slope transition in the Silurian of Washington Land, North Greenland. J.M.Hurst, F.Surlyk (Gronlands Geologiske Undersogelse, Copenhagen, Denmark).
Can. J. Earth Sci. (Canada), vol.20, no.3, p.473-99 (March 1983).
During the earliest Silurian, subsidence and tilting of a relatively flat carbonate platform produced a homoclinal carbonate ramp transitional to the slope of a deep-water basin. Further subsidence, associated with a flexure, differentiated the slope from the carbonate ramp. Subsequently, a linear reef tract developed along part of the flexure, producing a steep reef-scarp slope at the outer homoclinal carbonate ramp margin and accentuating the initial basin slope. Isolated reefs also developed on the slope. The reef tract, marked the transition from the shallow homoclinal carbonate ramp facies to the deeper slope environments. Sedimentation patterns along the incipient slope are discussed. With continued subsidence and differentiation of slope and ramp, slumping of carbonate blocks occurred at the ramp margin. Disorganized talus wedges developed as circular fringes around reefs on the slope, and a fine-grained talus wedge developed along the base of the main precipitous reef scarp at the ramp margin. A large channel cut down and across the slope and eventually became choked with ramp-margin reef and top-of-slope material. Finally, abrupt subsidence drowned all reefs and the slope became essentially starved of resedimented carbonate debris. (77 refs.)

73797 Discovery of striated calcareous concretions in the Gentilly Till of Saint Laurent, Quebec. M.Lamothe (Dept. of Geology, Univ. of Western Ontario, London, Ontario, Canada), C.Hillaire-Marcel, P.Page.
Can. J. Earth Sci. (Canada), vol.20, no.3, p.500-5 (March 1983). In French.
The discovery of striated calcareous concretions in the Gentilly Till supports the hypothesis of an early episode of carbonate precipitation in a glaciolacustrine environment that occurred before the St. Lawrence Lowlands became covered by the last ice advance. Finite ^{14}C ages have been obtained on two such concretions. These ages are in agreement with several others obtained previously on concretions from Lake Deschaillons varves. They suggest a maximum age of ca. 35000 BP for the Gentilly Till deposition. Inasmuch as the underlying St. Pierre sediments have been dated at ca. 75000 BP, the St. Lawrence Lowlands would have been ice-free during a large part of the Wisconsinan stage. (17 refs.)

73798 Synthetic cyclic stratigraphy. D.L.Turcotte, R.J.Willemann (Dept. of Geological Sci., Cornell Univ., Ithaca, NY, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.89-96 (April 1983).
A harmonic variation in sea level is superimposed on a constant velocity of tectonic subsidence in order to generate synthetic cyclic stratigraphy. Maximum rates of sedimentation and erosion are considered. The age dependence and water depth of the resulting cyclic stratigraphy is determined. The results are compared with cyclic sedimentation in the Pennsylvanian age sediments in northwestern Kansas. Spatial variations of synthetic cyclic stratigraphy can be used to generate synthetic seismic stratigraphy. (8 refs.)

Tectonic and geologic evolution of southeast asian seas and islands. Pt.2 ....See Entry 69796

Plasticity analysis of slope with different flow rules ....See Entry 71393

Nuclear waste repository characterization: a spatial estimation/identification approach ....See Entry 73501

Paleomagnetism of Late Archean metavolcanics and metasediments, Abitibi orogen, Canada: tholeiites of the Kinojevis Group ....See Entry 73715

Optical properties of the Earths mantle: refraction of temperature radiation ....See Entry 73750

Pb-Sr isotope variation in Indian Ocean basalts and mixing phenomena ....See Entry 73764

Stress magnitudes in natural rock salt ....See Entry 73790

91.90 OTHER TOPICS IN SOLID EARTH GEOPHYSICS

73799 Cemented horizon in subarctic Alaskan sand dunes. G.W.Cox, W.T.Lawrence (Dept. of Biology, San Diego State Univ., San Diego, CA, USA).
Am. J. Sci. (USA), vol.283, no.4, p.369-73 (April 1983).
A thin petrocalcic horizon occurs in the Great Kobuk Sand Dunes of western subarctic Alaska. This cemented layer probably formed in late Wisconsin time by the leaching of carbonates in the original sand and in subsequently deposited loess and has been exposed by recently renewed dune field activity. (12 refs.)

73800 On one-dimensional calculations of motions in an explosion in weak two-dimensional problems. A.V.Zabrodin, V.V.Kadet, L.A.Pliner, I.F.Podlivayev, V.I.Selyakov.
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.1, p.45-50 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.1 (1982).
The possibility of applying one-dimensional techniques to studying two-dimensional problems in gas-dynamics, is examined. For the problem concerning an underground explosion in a layer, the characteristic difference in the results of two-dimensional and one-dimensional calculations, is demonstrated. The upper estimate of the difference between the two-dimensional and unidimensional calculations is found analytically. The class of problems for which the estimate obtained holds, is indicated. A comparison between the theoretical estimate obtained by the author and the actual calculated difference is made. (9 refs.)

73801 Classification of arid geomorphic surfaces using Landsat spectral and textural features. E.H.H.Shih (Dept. of Geosci., Univ. of Arizona, Tucson, AZ, USA), R.A.Schowengerdt.
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.3, p.337-47 (March 1983).
A computationally efficient texture extraction algorithm which measures the local edge amplitude and density of an image is used to derive textural features from Landsat MSS data. Three of these derived textural features are added to the original four Landsat bands in a multifeature geomorphic classification of a natural arid terrain. The addition of textural features significantly improved training class separability when compared to a spectral only classification. Classification improvement, as determined by photointerpretation and by comparison to geologic/geomorphic map, was significant. (30 refs.)

Annual Meeting of the Seismological Society of America ....See Entry 69776

Evolution of the Earth ....See Entry 69784

Nuclear waste repository characterization: a spatial estimation/identification approach ....See Entry 73501

Permafrost, heat flow, and the geothermal regime at Prudhoe Bay, Alaska ....See Entry 73762

Morphometry of open rock basins, Kananaskis area, Canadian Rocky Mountains ....See Entry 73795

Late Quaternary glacial history of the hermitage area of southern Newfoundland ....See Entry 73845

Isotopic composition of the ocean-atmospheric system in the geologic past ....See Entry 73916

Relict drainages, conical hills, and the eolian veneer in southwest Egypt—applications to Mars ....See Entry 74025

92.00 HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

(for marine geology and geophysics, see 91.50)

92.10 PHYSICS OF THE OCEANS

(see also 43.30 Underwater sound)

73802 Geo-acoustic models for propagation modelling in shallow water. D.M.F.Chapman, D.D.Ellis (Defence Res. Estab. Atlantic, Dartmouth, Nova Scotia, Canada).
Can. Acoust./Acoust. Can. (Canada), vol.11, no.2, p.9-24 (April 1983).
Acoustic propagation in shallow water is viewed as a guided-wave phenomenon, with the sea surface and seabed forming the boundaries. At sub-kilohertz frequencies, the acoustic properties of the seabed to a depth of several wavelengths can have a strong effect on propagation. The computer modelling of propagation requires estimates of such parameters as sound speed, density, attenuation, and layer thicknesses, which are collectively called the geo-acoustic model of the seabed. Direct measurement of these quantities is difficult, and methods must be devised to infer these values from other experiments, often employing acoustic techniques. At DREA, the authors have adopted the approach of independently determining as many geo-acoustic parameters as possible, and adjusting the less precisely known parameters within reasonable limits to effect an agreement between theory and experiment. To this end, they have used sub bottom vertical reflection profiles to determine sediment types and thicknesses, large and small scale seismic refraction experiments to estimate sound speeds, and processing of sub-bottom reflection data to estimate volume attenuation. Examples of geo-acoustic models and comparisons with experiment are presented for shallow water sites on the Scotian Shelf and the southwestern approaches to the English Channel. (20 refs.)

73803 Evolution of liquid and solid discharges of a sub-boreal estuary: St. Jean river, Quebec (north coast of Gulf of St. Lawrence). D.Cataliotti-Valdina, B.F.Long (INRS-Oceanologie, Rimouski, Quebec, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.184-94 (Feb. 1983). In French.
The hydrodynamics of the St. Jean River estuary, particularly the flow dynamics, was evaluated and the mixing mechanisms were studied for fluvial water-marine water. In order to realize this objective, two series of measurements were undertaken on the solid and liquid discharges: the first took place during the spring flood (May 1980), the latter in conditions of lowest level spring tide (August 1980). The average stream discharge is 1035 m^3/s during floods and 85 m^3/s at periods of lowest water level. When the stream discharges exceed 160 m^3/s, the wedge of salt water is pushed out of the estuary and no reversed currents are present; there is only a reduction of current velocity at the mouth of the river. The quantities of solid particles in suspension vary from 96 mg/L during floods (65-95% mineral matter) to 4.6 mg/L for lowest water levels (58% mineral matter). The general behaviour of the St. Jean River estuary suggests a new type of environment, the subboreal estuaries. (20 refs.)

73804 On the effect of bathymetry in numerical storm surge simulation experiments. B.Johns (Dept. of Meteorology, Univ. of Reading, Reading, England), P.C.Sinha, S.K.Dube, U.C.Mohanty, A.D.Rao.
Comput. & Fluids (GB), vol.11, no.3, p.161-74 (1983).
A numerical model is described for the simulation of storm surges which uses a non-uniform off-shore grid-spacing adjacent to coastal boundaries. This permits an increased resolution near the coast in the models previously described. Using data on the 1977 Andhra cyclone, which struck the east coast of India, it is shown that the near-coastal bathymetry is critical in determining the coastal surge-induced sea-surface elevation. It is also shown that the coastal surge response is effectively independent of the depth of water in the deepest regions of the analysis area. Conclusions are drawn concerning the selection of an optimum resolution in the numerical scheme together with the proper representation of the bathymetry. (10 refs.)

73805 Recent changes in sea level and their possible causes. T.P.Barnett (Scripps Instn. of Oceanography, Univ. of California, San Diego, La Jolla, CA, USA).
Clim. Change (Netherlands), vol.5, no.1, p.15-38 (1983).
A new analysis of 'global' sea level is made that largely avoids the space/time bias of previous works. A coherent pattern of increasing relative sea level (RSL) is found to exist on average at all stations analyzed between 1903-1969. Subject to considerable assumptions, the rate of RSL increase associated with this pattern was 15 cm/century. A similar analysis of the period 1930-1975 again showed RSL increasing on average everywhere except in the western half of the North Pacific Ocean. Potential causes of the RSL change are investigated: approximately equal melting of Greenland/Antarctica, change in sea surface temperature, thermal expansion of the oceans, Earth rotation variation, ocean circulation and/or subsidence along all the coastal margins. (58 refs.)

73806 Orientational effects in geophysical fluid dynamics. N.V.Bagriantsev, A.I.Danilov, V.O.Ivchenko (Arctic & Antarctic Res. Inst., Leningrad, USSR), V.N.Nikolaevsky.
Int. J. Eng. Sci. (GB), vol.21, no.7, p.725-39 (1983).
The approach, accounting for the interaction between essentially different scales of turbulent fluid motions on a rotating sphere, is developed. Representation of the large-scale oceanic circulation as a turbulent flow with orientational effects due to synoptic (mesoscale) eddies is the basis of this technique. The scale of these eddies is much less than that of the considered problem, their energetic significance however is important. Such representation leads to employment of nontrivial angular momentum equation, i.e. to micropolar or asymmetrical hydrodynamics. It allows one to define a function which would characterize the averaged vorticity of mesoscale (subgrid) motions and does not relate to the mean flow vorticity. Using this parameterization, the calculations with barotropic and 2-layer global ocean models have been carried out. The model results do show an increase of basic ocean gyre transports. (35 refs.)

73807 Rays and local modes in a wedge-shaped ocean. J.M.Arnold (Dept. of Electrical & Electronic Engng., Univ. of Nottingham, Nottingham, England), L.B.Felsen.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1105-19 (April 1983).
Conventional normal mode theory cannot be applied to the nonseparable problem of wave propagation in an ocean with sloping bottom. For small bottom slopes, the sound field may be expressed approximately in terms of adiabatic modes, but this description fails when a mode propagating upslope passes through cutoff. An alternative solution by ray acoustics, valid at high frequencies, contains many multiply reflected contributions, and also undergoes difficult trapped to leaky ray transitions upslope. To address these transition problems, the conventional ray solution is used as a convenient starting point for collective treatment of ray fields and their conversion into local modes. First, the ray fields are generalized by associating with each ray trajectory from source to observer a bundle of local plane waves that is multiply reflected between the boundaries and remains valid also in the transition regions. When the generalized ray series is subjected to Poisson summation and subsequent asymptotics on the transform integrals, it is found to furnish local modes which coincide with the conventional adiabatic modes where these exist. The local mode integrals also yield transition functions which smoothly continue an originally trapped adiabatic mode through cutoff to the leaky regime. The transition behavior agrees with that found by Pierce [J. Acoust. Soc. Am. 72, 523-531 (1982)] by an entirely different approach, and with that predicted by the spectral Green's function method of Kamel and Felsen [J. Acoust. Soc. Am. 73, 1120-1130 (1983)]. The utilization of rays and local modes in each step of the analysis grants physical insight and therefore clarifies the mechanism of propagation in this range-dependent environment. (13 refs.)

73808 Spectral theory of sound propagation in an ocean channel with weakly sloping bottom. A.Kamel, L.B.Felsen (Dept. of Electrical Engng. & Computer Sci., Polytech. Inst. of New York, Farmingdale, NY, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1120-30 (April 1983).
Spectral representations based on the theory of characteristic Green's functions (resolvents) have been used effectively for studying sound propagation in a coordinate separable ocean environment. Such representations are generalized to accommodate weak nonseparability as represented by a homogeneous water channel separated from a homogeneous sediment by a gradually and monotonically sloping bottom. The generalization involves the use of adiabatic invariants for the spectral integration variable and of symmetrizing factors in order to insure that the Green's function, so expressed, reduces by residue calculus to the conventional adiabatic trapped mode expansion whenever that is valid. However, subject to ignoring coupling between the adiabatic modes, the generalized Green's function contains all of the spectral information (discrete and continuous) for upslope propagation from a source to arbitrary observation points in the water or the bottom, and it can be used to derive ray, hybrid ray-mode, and other formulations in this configuration. Numerical evaluation of the spectral integral and comparison with results obtained independently by the parabolic equation algorithm have confirmed its validity for a typical range of observer locations. Asymptotic considerations have been employed to clarify the mechanism of adiabatic mode transition from trapped to radiating in terms of lateral and leaky waves, and to reduce the spectral integral to a simpler canonical transition function similar to those of Pierce [J. Acoust. Soc. Am. 72, 523-531 (1982)] and of Arnold and Felsen [J. Acoust. Soc. Am. 73, 1105-1119 (1983)] which were derived by entirely different methods. (8 refs.)

73809 Low-frequency propagation in almost fluid sediments: role of gravity and other stresses. I.Tolstoy.
J. Acoust. Soc. Am. (USA), vol.73, no.4, p.1200-4 (April 1983).
Relatively unconsolidated sediments of low rigidity μ are common in oceans. Shear modes of low velocity $c_s (c_s \leq 100\ ms^{-1})$ then exist in sea floor sediments, as well as slow boundary waves of velocity $\nu < c_s$ at the water-sediment interface (Stoneley modes). Both have been observed in shallow water experiments at frequencies in the 1-5 MHz band [Rauch, Bottom-Interacting Acoustics (Plenum, New York, 1980)]. In poorly consolidated sediments of this kind ($\mu < 10^9$ dyn cm^{-2}) gravity and other stresses introduce small corrections to the propagation velocities. The role of gravity is of two sorts. On the one hand it introduces buoyancy forces and internal gravity waves—these are negligible for frequencies above 10^{-1} Hz; on the other, it introduces hydrostatic stresses which primarily affect the velocity of shear modes in the sediment—leading to corrections of order $\rho g z/\mu$ (for an overburden of height z in a sediment or sediment+water column of mean density ρ). While the latter measurably affects propagation speeds in sediments, it is an isotropic effect which, in practice, finds itself lumped with other mechanisms of velocity stratification. Interesting and in principle more easily diagnosed in experiments are the effects of anisotropic stress fields—e.g. tensions and compressions associated with gravity slumping mechanisms on slopes and, for deeper and somewhat more consolidated sediments, with forces of local origin such as island loading or tectonic stresses. These can introduce measurable anisotropies into the propagation of various low-frequency bottom associated modes. (18 refs.)

73810 Long-range Atlantic acoustic multipath identification. G.R.Legters (Government Communications Systems Group, Harris Corp., Melbourne, FL, USA), N.L.Weinberg, J.G.Clark.
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1571-80 (May 1983).
Multipath data from three long-range (900 km) transmissions are examined. Two of the transmissions follow similar tracks, with one ending in the Gulf Stream at the receiving end. The third, which is substantially free of Gulf Stream influence, has been extensively studied by Spiesberger et al. [ibid., vol.67, p.2011-2017 (1980)]. The path structure of the transmission crossing the Gulf Stream was characterized by low S/N and appeared to be unstable. Path identification with ray calculations was attempted for the two transmission channels exhibiting stable multipath with success for the major features of the path structures. Excessive smoothing of the sound-speed profile which eliminates the influence of the Atlantic 18° water in the upper layers is shown to degrade the identification of early arrivals. The slight curvature of the ocean sound-speed profile around 4 km of depth also was critical to early arrival identification. The effect of weak range dependence was small while the effect of a gradual sloping bottom near one receiver was significant. (18 refs.)

73811 Acoustic ocean with a propagation in the poro-elastic bottom. T.Yamamoto (Ocean Engng. Div., Rosenstiel School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1587-96 (May 1983).
The acoustic normal modes in a homogeneous ocean overlying a homogeneous porous elastic bottom half-space are obtained in closed form. The Biot theory is used to model the bottom. The effects of sediment properties of the dispersion and attenuation of acoustic waves are examined numerically. It is found that the shear modulus and the poro-viscous-frequency number $k_s f/\beta\nu$ are the two most critical bottom parameters for acoustic attenuation. Here, k_s is

permeability, f is frequency, β is porosity, and ν is the kinetic viscosity. For sediment and rocks having shear modulus larger than 5×10^7 N/m^2, the shear waves and the slow compressional waves become important in acoustic propagation. For hard porous rocks, such as sandstones and corals, the attenuation of acoustic waves by a porous rock increases with frequency. For a given soft sediment, the acoustic attenuation becomes maximum when the sediment properties are such that $k_s f/\beta\nu$ is about 0.1. Near the critical value $k_s f/\beta\nu=0.1$ the energy loss is totally due to the fast compressional waves and the fluid model may be used. However, as $k_s f/\beta\nu$ deviates from 0.1, the error associated with the fluid bottom approximation increases progressively and becomes unacceptable even for soft sediments. (25 refs.)

73812 Mesoscale variability of SOFAR group velocity in the Northwest Pacific. R.C.Schockley, S.M.Montoya (Naval Ocean Systems Center, San Diego, CA, USA).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1597-600 (May 1983).
Presents a ray-trace numerical study of the effects of mesoscale structure of the group velocity (defined as the average horizontal ray speed) of deep-refracted acoustic signals using data from a large-scale, near synoptic surface of the thermal structure in the upper 800 m of the Northwest Pacific Ocean reported by W.J. Emery, T.J. Reid, J.A. de Santo, R.N. Baer, and J.P. Dugan, (ibid., vol.66, 831-841, 1979). A representative sample of twelve sound speed profiles (SSPs) from the survey show maximum variation of 10 m/s in the group velocity of a ray with a given J value, J being the phase integral, and illustrate how particular features in the SSPs cause local maxima in the group velocity as a function of J. (6 refs.)

73813 Modeling ocean-bottom reflection loss measurements with the plane-wave reflection coefficient. N.R.Chapman (Defence Res. Establ. Pacific, FMO Victoria, British Columbia, Canada).
J. Acoust. Soc. Am. (USA), vol.73, no.5, p.1601-7 (May 1983).
Ocean-bottom reflection loss has been measured at an abyssal plain site in the northeast Pacific Ocean. The layer of unconsolidated sediment at this site is thin (less than 200 m), and the near-surface sediments are composed of strongly reflecting sandy turbidites. In consequence, the surficial sediments and the relatively shallow substrate must be accounted for in describing the bottom loss measurements. The bottom loss has been modeled in this paper using the plane-wave reflection coefficient calculated for a geoacoustic model of the bottom developed from seismic profiling experiments carried out at the site. In the model the sediment column is described by fluid layers with a relatively small value of attenuation and a large value of sound-speed gradient in the surficial layer, and the substrate is assumed to be a solid. The bottom loss measurements are presented in 1/3 octave bands at 40, 80, and 160 Hz. The results are well-modelled at small grazing angles ($\theta\leq20°$) where the interaction is confined to the surficial sediments. At large grazing angles the importance of including a solid substrate is demonstrated. (19 refs.)

73814 Recent long-term moored instrument observations in the western North Pacific. W.J.Schmitz,Jr. (Woods Hole Oceanographic Inst., Woods Hole, MA, USA), P.P.Niiler, R.L.Bernstein, W.R.Holland.
J. Geophys. Res. (USA), vol.87, no.C12, p.9425-40 (20 Nov. 1982). [received: May 1983]
Selected results based on the first deployment (duration was 298-324 days depending on specific location) of an array of 38 current-temperature meters on 10 moorings along 152°E from 28°N to 41°N are discussed. Abyssal eddy kinetic energies along 152°E near the Kuroshio Extension are a factor of 2 to possibly 5 lower than those previously observed at similar depths close to the energetic regions of the Gulf Stream. The thermocline kinetic energy frequency distribution at 28°N, 152°E is similar in shape to that observed at a site near 31°N, 70°W (but not 28°N, 70°W), although the total energy levels are quite different. However, the distance from the corresponding strong current regimes is nearly the same. The largest scale latitudinal distribution of the off-diagonal component of horizontal Reynolds' stress has a characteristic general shape, that is, negative to the south and positive to the north of the Gulf Stream or Kuroshio Extension or mid-latitude jet. (43 refs.)

73815 Chlorofluoromethanes in the Northeast Pacific Ocean: measured vertical distributions and application as transient tracers of upper ocean mixing. R.H.Gammon (Dept. of Chem., Univ. of Washington, Seattle, WA, USA), J.Cline, D.Wisegarver.
J. Geophys. Res. (USA), vol.87, no.C12, p.9441-54 (20 Nov. 1982). [received: May 1983]
The vertical distributions of the man-made chlorofluoromethanes CCl_3F (F-11) and CCl_2F_2(F-12) have been measured at two locations in the eastern North Pacific Ocean to depths greater than 500 m. At both sites (46°N, 125°W off the Washington-Oregon coast and 50°N, 140°W in the Gulf of Alaska) the halomethane concentrations were found to fall off exponentially with increasing depth below the mixed layer. For F-11 at 50°N, the surface concentration was found to be in saturation equilibrium with the measured atmospheric concentration. The measured chlorofluoromethane profiles have been interpreted in terms of a one-dimensional model for the vertical diffusion advection of an exponentially driven, conservative tracer into a bottomless ocean. In the appropriate limit of 'transient steady state' the projected profiles are simple exponentials described by an advective-diffusive scale depth H, which is a function of the vertical eddy diffusivity K_z, the upwelling velocity w, and the characteristic time τ for the exponential growth of the tracer concentration at the boundary. (39 refs.)

73816 Gulf Stream meanders: observations on propagation and growth. D.R.Watts, W.E.Johns (Graduate School of Oceanography, Univ. of Rhode Island, Kingston, RI, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9467-76 (20 Nov. 1982). [received: May 1983]
Presents a new method for continuously tracking the location of the Gulf Stream using a moored array of inverted echo sounders. Time series of lateral displacements of the front, shown accurate to ±8 km, have been collected along three sections spaced 100, 150, and 200 km downstream (NE) of Cape Hatteras, North Carolina, for a period of 12 months. These records are highly coherent at all periodicities longer than 4 days. From the observed phase lags, a dispersion relationship is presented for the meanders: as the period and wavelength (T, λ) increase from (4 days, 180 km) to (30 days, 600 km), the phase speed decreases smoothly from 40 to 20 km d^{-1}. The meanders exhibited rapid growth at periods longer than 4 days, doubling in variance in each 50-km step downstream. (23 refs.)

73817 Energy saturation and phase speeds measured on a natural beach. E.B.Thornton (Naval Postgraduate School, Monterey, CA, USA), R.T.Guza.
J. Geophys. Res. (USA), vol.87, no.C12, p.9499-508 (20 Nov. 1982). [received: May 1983]
Field measurements of wave height and speed from 7-m depth shoreward are described. The experiment plan consisted of a shore-normal transect of closely spaced (compared to a dominant wave length) velocity, pressure, and elevation sensors on an almost plane profile having an inshore slope of 1:50. As the waves shoal and begin to break, the dominant dissipative mechanism is due to turbulence generated at the crest, and wave heights become increasingly depth controlled as they progress across the surf zone. Wave heights in the inner surf zone are strongly depth dependent; the envelope of the wave heights is described by $H_{rms}=0.42$ h. The depth dependence of the breaking wave height is shown to be related to the kinematic instability criterion. Celerity spectra were measured by using phase spectra calculated between pairs of adjacent sensors. (34 refs.)

73818 Continental shelf waves of diurnal period along Vancouver Island. W.R.Crawford, R.E.Thomson (Inst. of Ocean Sci., Sidney, BC, Canada).
J. Geophys. Res. (USA), vol.87, no.C12, p.9516-22 (20 Nov. 1982). [received: May 1983]
Recent surveys of tides and currents on the continental shelf along the west coast of Vancouver Island have shown the diurnal tide currents to be larger than the semi-diurnal by a factor of 2-4, although the ratio $(K_1+O_1)/(M_2+S_2)$ for the tidal heights is only 0.6. The authors attribute the diurnal currents to continental shelf waves, and show that the continental shelf and slope off Vancouver Island allow first mode barotropic shelf waves at the diurnal frequency. The tidal heights and deep water currents of K_1 and O_1 frequency behave as progressive Kelvin waves with height 43 cm at shore, and currents of 1-2 cm/s. The observed shelf waves at these frequencies have amplitudes at shore of 5 and 3 cm, and currents of order 10 and 6 cm/s, respectively. The Kelvin and shelf waves are in phase near Ucluelet and out of phase near Kyuquot, as determined by both current meter and shore tide gauge observations. (18 refs.)

73819 The subtropical front: satellite observations during FRONTS 80. M.Van Woert (Scripps Inst. of Oceanography, La Jolla, CA, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9523-36 (20 Nov. 1982). [received: May 1983]
Satellite-derived sea surface temperature, in situ hydrography data, and satellite-tracked drifter data collected during winter 1979-1980 as part of the FRONTS 80 experiment are used to describe the spatial structure of the North Pacific subtropical front northeast of Hawaii. The satellite observations reveal a deformation scale meander (85 km×32 km) in association with the front having an evolution time scale of ~60 days. The satellite measurements of the change in sea surface temperature across the front are typically 1°C within a distance of 10 km. The correlation coefficients between the satellite data and the in situ hydrographic data were computed and found to be significantly nonzero above 800 m. The high correlation at deep levels indicates that the satellite was viewing a feature with sizeable vertical extent, not just a surface phenomenon. (30 refs.)

73820 Oceanographic aspects of the Emperor Seamounts region. G.I.Roden (School of Oceanography, Univ. of Washington, Seattle, WA, USA), B.A.Taft, C.C.Ebbesmeyer.
J. Geophys. Res. (USA), vol.87, no.C12, p.9537-52 (20 Nov. 1982). [received: May 1983]
Effects of the Emperor Seamount Chain on the thermohaline structure and baroclinic flow are investigated on the basis of historical hydrographic data. The amplitudes of dynamic height perturbations are 3 to 5 times larger west than east of the chain. The intensity of the thermal fronts is stronger west than east of the seamounts; near the crest of the southern seamounts, strong east-west thermohaline fronts and a strong northward baroclinic flow are observed. The Kuroshio Extension west of the seamount chain is a well-defined meandering current, the axis of which generally lies between 33° and 36°N. The available data indicate that the Kuroshio Extension turns northward and then flows eastward through the gaps of the seamount chain. East of the seamounts, the Kuroshio Extension widens threefold and appears to be poorly defined. (50 refs.)

73821 An analysis of the optical features of the near bottom and bottom nepheloid layers in the area of the Scotian Rise. R.W.Spinrad, J.R.V.Zaneveld (School of Oceanography, Oregon State Univ., Corvallis, OR, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9553-61 (20 Nov. 1982). [received: May 1983]
Profiles of light transmission versus depth have been studied in the region of the Scotian Rise of the North Atlantic at the bottom depths between 4900 and 5000 m. A component model has been developed and consists of three components of transmission which can be combined to duplicate accurately any given transmission profile. Two of the components are shown to be representative of several basic phenomena: the particle concentration within a uniform flow and the separation of a benthic nepheloid layer. In the case of a uniform flow it is the relative magnitudes of settling and eddy diffusion which determine the shape of the transmission profile. Separation of the benthic nepheloid layer was inferred to be caused by an occasional cross-slope velocity component. The physical interpretation of the third component was ambiguous. Benthic storms were observed. (20 refs.)

73822 Circulation in the Hudson Shelf Valley: MESA physical oceanographic studies in New York Bight. I. D.A.Mayer, G.C.Han, D.V.Hansen (Atlantic Oceanographic & Meteorological Labs., NOAA, Miami, FL, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9563-78 (20 Nov. 1982). [received: May 1983]
Over 900 days of current velocity data were obtained at mainly two locations in the inner and outer Hudson Shelf Valley (HSV). The large cross-axis depth gradients in the HSV, together with the strong winter cyclones and the baroclinic density distribution over the shelf, are primarily responsible for the major circulation features observed in the valley. CSTD data from 12 cruises and meteorological data from JFK International Airport and an environmental buoy were collected concurrently with the current meter data. Although the mean cross-shelf pressure gradient is generally seaward in the Middle Atlantic Bight, it is shoreward in the HSV below the level of the adjacent continental shelf (shelf horizon), thus imposing a bias towards upvalley flow. The average velocity below the surrounding shelf horizon in the HSV is upvalley or shoreward (west-northwestward ≈290° T) in the range of 2-5 cm/s. The circulation in the HSV is seasonal and individual events can drastically alter the mean picture. (28 refs.)

73823 The structure of circulation: MESA physical oceanographic studies in New York Bight. II. D.A.Mayer (Atlantic Oceanographic & Meteorological Labs., NOAA, Miami, FL, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9579-88 (20 Nov. 1982). [received: May 1983]
For pt.I see ibid., vol.87, no.C12, p.9563-78 (1982). The structure of velocity in New York Bight (NYB) is examined for motions in the low frequency meteorological band (periods greater than 3 days) and for those in the semi-diurnal band during the years 1975, 1976, and 1978. An empirical modal analysis suggests that, in the lower part of the water column in the unstratified season, nearly 80% of the low frequency energy is in phase across the shelf and is organised along the major isobaths. These motions exhibit a remarkable coherence that is visually apparent across the shelf for distances up to 80 km. Near-surface motions are less organised presumably because of the surface wind stress field. Maximum coherence between the observed wind

stress and currents occurs with wind angles that vary from 60° T near the New Jersey coast to 80° T at mid-shelf just northeastward of the Hudson Shelf Valley which is consistent with the analysis of sea level records by Wang (1979). The analysis suggests the existence of a wind-coherent disturbance propagating southwestward on the outer shelf at about 540 km/day. (15 refs.)

73824 Variability of the near-surface residual current in the lower St. Lawrence estuary. M.I.El-Sabh, H.-J.Lie (Dept. d'Oceanographie, Univ. du Quebec, Rimouski, Quebec, Canada), V.G.Koutitonsky.
J. Geophys. Res. (USA), vol.87, no.C12, p.9589-600 (20 Nov. 1982). [received: May 1983]
Current measurements of 1- and 4- month duration from May 1979 taken at 10 stations in the lower St. Lawrence estuary were subject to time series analysis. It was found that the spectral energy density of the near-surface current in the sub-inertial frequency range is comparable to the energy concentrated in the semi-diurnal frequency band. The strong residual current decreases rapidly with depth while the tidal current is more or less uniform from surface to bottom. A cross-spectral analysis showed that the longshore current at a station near the south shore was negatively correlated to the current at a north shore station with high coherence in the period range greater than 7 days. Evidence was found for the existence of a cross-channel current at stations in the centre of the channel. The near-surface circulation system in the area was classified into three types of pattern. (22 refs.)

73825 Vertical overturns: a comparison of Thorpe and Ozmidov length scales. T.M.Dillon (School of Oceanography, Oregon State Univ., Corvallis, OR, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9610-13 (20 Nov. 1982). [received: May 1983]
An objective measure of the length scale of turbulent overturning events, the Thorpe scale, L_T, is compared to the Ozmidov scale $L_0=(\epsilon/N^3)^{1/2}$, where N is the buoyancy frequency and ϵ is the kinetic energy dissipation rate. Far from the surface in wind-forced mixing layers and in the seasonal thermocline, L_0 and L_T are of the same order, but near the surface of a mixing layer, L_0 is significantly larger than L_T. The change in the ratio L_0/L_T is attributed to a decrease in the gradient Richardson number in the highly energetic zone near the surface. Another length scale, $L_B=(DC_x/N)^{1/2}$, where C_x is the Cox number and D is the molecular diffusivity of temperature is also discussed. (17 refs.)

73826 Spring season flow of the Tsushima Current and its separation from the Kuroshio: satellite evidence. O.K.Huh (Coastal Studies Inst., Louisiana State Univ., Baton Rouge, LA, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9687-93 (20 Nov. 1982). [received: May 1983]
Attempts to determine where and how separation between the Kuroshio and Tsushima Current occurs have been inconclusive. Spring season satellite data acquired over a number of years reveals two conditions important to this question: (1) an already extensive zone of mixing between the Kuroshio and shelf waters occurring along the edge of the East China Sea shelf, and (2) plumes of warm water from the Kuroshio extending into the mixed water west of Kyushu. This mixed water is observed to form the Tsushima Current in the outer shelf of the northern East China Sea and Korea Strait. Warm plumes branching from the north wall of the Kuroshio are seen with particular clarity in imagery of April 23, 1981, and February 21, 1982. Details of the split suggests that branching was a transient event. (23 refs.)

73827 Radium 228 as a tracer of basin wide processes in the abyssal ocean. J.L.Sarmiento (Geophys. Fluid Dynamics Program, Princeton Univ., Princeton, NJ, USA), C.G.H.Rooth, W.S.Broecker.
J. Geophys. Res. (USA), vol.87, no.C12, p.9694-8 (20 Nov. 1982). [received: May 1983]
A simple model of isopycnal mixing in a circular basin is developed in order to examine the utility of the 5.75-year half-life tracer radium 228 for studying basin wide processes in the deep ocean. The model shows that it is possible to resolve diffusivities of $\lesssim 8\times 10^7$ cm^2 s^{-1} in a basin of ~3000-km diameter with profiles measured near the centre and edge of the basin. A least squares fit of the model to four abyssal profiles measured during GEOSECS in the North American Basin gives an isopycnal diffusivity of 6×10^7 cm^2 s^{-1}. (16 refs.)

73828 Wind-stress coefficients over sea surface from breeze to hurricane. Jin Wu (Coll. of Marine Studies, Univ. of Delaware, Newark, DE, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9704-6 (20 Nov. 1982). [received: May 1983]
The empirical formula proposed recently relating wind-stress coefficients to wind velocity, $C_{10}=(0.8+0.065\ U_{10})\times 10^{-3}$, appears to be applicable even in hurricanes. This formula also agrees with the correlation curve proposed earlier, $C_{10}=[\kappa/\ln(1/aC_{10}F^2)]^2$, $F=U_{10}/(gZ)^{1/2}$, where $a=0.0185$ is the Charnock constant and $Z=10$ m is the anemometer height. (18 refs.)

73829 Observations of eastward currents in the tropical South Atlantic Ocean: 1978-1980. R.L.Molinari (Atlantic Oceanographic & Meteorological Labs., NOAA, Miami, FL, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9707-14 (20 Nov. 1982). [received: May 1983]
Data from four cruises to the tropical South Atlantic Ocean are used to describe the current distribution at 25°W and 27.5°/28°W. Two distinct eastward-flowing countercurrents separated by a branch of the westward-flowing South Equatorial Current (SEC) were observed during all the cruises. The South Equatorial Undercurrent, located between 3°S and 5°S, has a subsurface velocity core, with maximum speeds of about 0.4 m/s. Geostrophic volume transports of the SEUC, from the surface to 1000 m, range from 5 to 23 Sv. Surface flow above the core of the SEUC can be to the east or west. The South Equatorial Countercurrent (SECC) is located typically between 7°S and 9°S. Although weaker than the SEUC with transports ranging from 3 to7 Sv, the SECC also has a subsurface velocity core. (11 refs.)

73830 Surface-wave diffraction by a periodic row of submerged ducts. J.W.Miles (Inst. of Geophys. & Planetary Phys., Univ. of California, San Diego, CA, USA).
J. Fluid Mech. (GB), vol.128, p.155-80 (March 1983).
The diffraction of a gravity wave of length λ that is obliquely incident upon, and the radiation from, a periodic row of vertical circular ducts of radii a and horizontal spacing b with mouths at a distance h below the free surface of a deep ocean are determined through integral-equation and variational formulations. Numerical results for the reflection coefficient, the pressure-amplification factor (the ratio of the complex amplitude of the wave-induced pressure in the depths of the duct to that of the incident wave at the level of the mouths), and the radiation impedance (the real and imaginary parts of which are measures of the radiation damping and the virtual mass or stiffness of the fluid external to the ducts) are presented as functions of a/λ with a/b and a/h as parameters for the special case of normal incidence with $\lambda>b$ (which implies that the crests of the scattered waves are parallel to the midplane of the ducts). These results, which complement those of Simon (1981) for a single duct, are of practical interest for wave-power absorption. (17 refs.)

73831 The nonlinear Fourier analysis of internal solitons in the Andaman Sea. A.R.Osborne, A.Provenzale, L.Bergamasco (Istituto di Cosmo-Geofisica, CNR, Torino, Italy).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.18, p.593-9 (30 April 1983).
The authors have conducted a preliminary spectral analysis of large-amplitude internal solitons in the Andaman Sea. The methods are based upon the spectra (or scattering) transform solution of the Korteweg-de Vries equation. (8 refs.)

73832 Energy-containing eddies in the Strait of Messina. M.Abbate (Istituto di Fisica, Univ. di Roma, Rome, Italy), G.A.Dalu, E.Salusti.
Nuovo Cimento C (Italy), vol.5C, ser.1, no.5, p.571-85 (Sept.-Oct. 1982). [received: May 1983]
The velocity field, measured by Vercelli (1922-23) in the Strait of Messina hourly at six depths, is analysed to determine the size and intensity of the energy-containing eddies. The analysis is performed by separating the turbulent component of the velocity field from the deterministic tidal component. The intensity of the turbulence is given by the averaged square of the aleatoric velocities. The size of the eddies is computed through correlation of the aleatoric velocities at different depths. These eddies are far beyond the inertial range predicted by the Kolmogorov theory. The eddies are due to Kelvin-Helmoltz shear instabilities between the surface and the deeper water. (11 refs.)

73833 Influence of a water temperature anomaly in the north Atlantic on the circulation, thermal regime, and moisture cycle in the northern hemisphere atmosphere. V.P.Meleshko, A.P.Sokolov (Main Geophys. Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.38-47 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.51-62 (1982).
A model of the general atmospheric circulation is used to investigate the influence of a water temperature anomaly in the North Atlantic on the general circulation, thermal regime, and moisture cycle in the atmosphere. A positive anomaly is specified in the zone of active thermal interaction between the atmosphere and the surface in the northeastern Atlantic Ocean. The state of the Northern Hemisphere atmosphere is calculated for January conditions by integrating the equation system over a two-month period with and without consideration of the water-temperature anomaly. The authors include a detailed comparative analysis of the atmosphere's characteristics for the Northern Hemisphere and specific regions of the European continent. (32 refs.)

73834 Numerical experiments with a model of the active ocean layer. V.A.Ryabchenko (Inst. of Oceanography, Acad. of Sci., USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.48-52 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.63-8 (1982).
The integral model of the active ocean layer is improved to include feedback between the heat flux at the water-air interface and the surface temperature of the ocean. The results of calculation of the annual temperature cycle in the mixed layer in the area of weather station N agree well with observations. Numerical-experiment results illustrating the sensitivity of the solution to variations of the model parameters are presented. It is shown that the response of the solution is much stronger for variation of the external (atmospheric) parameters and weaker for variation of internal parameters. (7 refs.)

73835 Criteria characterizing flows of liquids with stable stratification. A.N.Shabrin (Inst. of Fluid Mech., Acad. of Sci., Ukrainian SSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.53-8 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.69-76 (1982).
Conditions under which salt water penetrates a fresh-water stream and the stability conditions of the interlayer boundaries when fresh water flows into the sea are investigated. A procedure is proposed for analysis of the nature of stably stratified fluid flows. It is established that there is a sharply defined and unique relation between the stability of the boundaries of the interlayer between liquids of unequal density and the ratio of the flow and buoyancy frequencies. Experimental results that confirm this are cited. (10 refs.)

73836 Accuracy of calculation of the parameters of wind waves at sea as a function of the basic wave-forming factors. R.A.Dalin (Leningrad Hydrometeorological Inst., Leningrad, USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.59-63 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.77-81 (1982).
The method of linearization of a function of random arguments is used to analyze the variation of the accuracy of calculation of the average heights and periods of wind waves on a deep sea as they depend on the errors in the initial values of the basic wave-forming factors—wind velocity, fetch, and action time. Accuracy characteristics are given for the main wave-forming factors and make it possible to calculate the parameters of wind waves accurately enough for practical requirements. It is shown that wind-velocity errors have the strongest influence on the accuracy of the calculations. (5 refs.)

73837 Forecasting the water salinity of the bottom horizon of the Gulf of Riga. E.N.Zakharchenko.
Sov. Meteorol. & Hydrol. (USA), no.3, p.49-55 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.65-73 (1982).
The conditions of formation of the salinity regime of waters of the Gulf of Riga are examined. Factors causing a change in water salinity in various regions of the gulf are established. Equations are calculated which permit forecasting salinity of the bottom horizons 1-15 months in advance. An example of forecasting is given. (17 refs.)

73838 Current state and prospects of numerical investigations of variations in the level of Arctic seas. N.V.Mustafin, A.Yu.Proshutinskii (Arctic & Antarctic Sci. Res. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.56-61 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.74-80 (1982).
Reviews numerical investigations of the variations in the level of Arctic seas. The tasks of improving models and combining numerical and field experiments are set forth. It is emphasized that the development of operational methods of forecasting the level should be based on combined numerical and physico-statistical investigations with consideration of practical experience. It is suggested to create a complex system for numerical hydrometeorological forecasts, provided the Arctic regional administrations for hydrometeorology and environmental control are supplied with modern electronic computers. (3 refs.)

Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC) ....See Entry 69777

Sea Level Ice and Climatic Change. Proceedings of a Symposium ....See Entry 69794

An examination of the composite-roughness scattering model . See Entry 71289

Nonlinear stage of the shearing instability in a stratified liquid of finite depth ....See Entry 71626

Hudson Bay river sediments and regional glaciation. II. Comparison of carbonate mineralogy of size fractions for ice movement inference ..See Entry 73782

Acoustic backscattering from the basin and margins of the Arctic Ocean .... See Entry 73786

Evidence of pre-late Wisconsinan glaciations on Labrador Shelf—Cartwright Saddle region .... See Entry 73842

Hudson Bay river sediments and regional glaciation. I. Iron and carbonate dispersal trains southwest of Hudson and James Bays .... See Entry 73843

On the correctness as a whole of boundary-value problems for models of the dynamics of the atmosphere and ocean .... See Entry 73865

Whitecap aerosol productivity deduced from simulation tank measurements .... See Entry 73880

Sea spray: a further look .... See Entry 73881

Effect of wind-generated waves on the transfer of solar radiation in the atmosphere-ocean system .... See Entry 73886

Kinetic energy dissipation in a cyclone over the ocean .... See Entry 73901

A two step linear statistical technique using leaps and bounds procedure for retrieval of geophysical parameters from microwave radiometric data .... See Entry 73919

Sea surface temperature estimation using the NOAA 6 satellite Advanced Very High Resolution Radiometer .... See Entry 73942

On the use of laser profilometry for ocean wave studies .... See Entry 73943

Sonar location system for freely floating buoys .... See Entry 73950

92.20 INTERDISCIPLINARY ASPECTS OF OCEANOGRAPHY

73839 Carbon monoxide in seawater (Atlantic Ocean). R.Conrad, W.Seiler, G.Bunse, H.Giehl (Max-Planck-Inst. fur Chem., Mainz, Germany).
J. Geophys. Res. (USA), vol.87, no.C11, p.8839-52 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).
In 1978-80, measurements of dissolved carbon monoxide in seawater were carried out during three ship expeditions in the northern and southern Atlantic Ocean, covering an area between 53°N and 35°S. Carbon monoxide concentrations in the water body increased toward the sea surface, there reaching saturation factors of up to 50 with respect to atmospheric CO. The daily average CO saturation increased with average chlorophyl, concentration and light intensity and decreased with wind speed. The dissolved CO showed strong diurnal variations, with maximum values in the afternoon. Diurnal variations were observed within the entire euphotic zone, indicating that CO is both produced and consumed in the seawater. Carbon monoxide production in seawater was mainly due to photooxidation of dissolved organic matter. Photobiological and microbial CO production processes were of minor importance. (34 refs.)

73840 Exchange of H_2S between air and water. J.Spedding, M.Vujcich (Chem. Dept., Univ. of Auckland, Auckland, New Zealand).
J. Geophys. Res. (USA), vol.87, no.C11, p.8853-6 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).
The overall exchange coefficient expressed on a gas phase basis, Kg, for the transfer of H_2S from water to air was measured in the laboratory by using radioactive H_2S. The exchange coefficient showed a strong dependence on solution pH that was found to be related to enhancement by ionisation of H_2S to HS^-. At low pH values, where this enhancement had no effect, the value of Kg was 2.3×10^{-2} cm s^{-1}. At seawater pH, Kg increased to 0.13 cm s^{-1} leading to the conclusion that at pH$<$5 liquid phase resistance dominates the exchange while with increasing pH gas phase resistance becomes increasingly important. (26 refs.)

Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC) .... See Entry 69777

The geochemistry of plutonium in fresh and marine water environments .... See Entry 73488

Hot springs on the ocean floor .... See Entry 73765

Chlorofluoromethanes in the Northeast Pacific Ocean: measured vertical distributions and application as transient tracers of upper ocean mixing .... See Entry 73815

Radium 228 as a tracer of basin wide processes in the abyssal ocean .... See Entry 73827

The flux of dimethylsulfide from the oceans to the atmosphere .... See Entry 73869

Exchange of sulfur between the free troposphere, marine boundary layer, and the sea surface .... See Entry 73870

Air-sea exchange of CO_2 and evidence for enhanced upward fluxes .... See Entry 73873

Measurements of ozone vertical flux to ocean and forest .... See Entry 73874

Magnitudes and sources of precipitation and dry deposition fluxes of industrial and natural leads to the North Pacific at Enewetak .... See Entry 73875

Sporadic transport and deposition of continental aerosols to the Pacific Ocean .... See Entry 73876

Nonsteady state simulations of the global mercury cycle .... See Entry 73879

Isotopic composition of the ocean-atmospheric system in the geologic past .... See Entry 73916

92.40 HYDROLOGY AND GLACIOLOGY

73841 The identification of Eemian Interglacial and Weichselian Interstadial deposits in Finland. J.Donner (Dept. of Geology, Univ. of Helsinki, Helsinki, Finland).
Ann. Acad. Sci. Fenn. Ser. AIII (Finland), no.136, p.1-38 (1983).
On the basis of their pollen assemblages and their stratigraphical position, the till-covered organic sediments in Finnish Lapland and Pohjanmaa can be correlated with the Eemian Interglacial and the Weichselian Perapohjola Interstadial, the latter corresponding to the Jamtland Interstadial in northern Sweden and possibly to the Karukula Interglacial in Estonia. The marine influence in southern Finland and the Karelian Isthmus during the Eemian can also be traced in the redeposited Eemian sediments in Pohjanmaa. No marine sediments of the Perapohjola Interstadial have been found in situ. In southern Sweden and Norway there is a younger, Middle Weichselian interstadial, possibly an interstadial complex, during which the central parts of the Weichselian glaciation may have been ice-free as during the earlier Weichselian interstadial. The till stratigraphy in central and southeastern Fennoscandia indicates that the Weichselian had two main ice advances separated by one non-glacial interval unknown duration. (80 refs.)

73842 Evidence of pre-late Wisconsinan glaciations on Labrador Shelf—Cartwright Saddle region. H.W.Josenhans (Atlantic Geosci. Centre, Dartmouth, Nova Scotia, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.225-35 (Feb. 1983).
High-resolution Huntec and air-gun seismic reflection profiles from Cartwright Saddle indicate the presence of at least three major glacial advances, which deposited glacial till sequences up to 100 m in composite thickness on the bottom and flanks of the saddle. These tills are found in water depths up to 600 m, and their acoustic character suggests deposition from grounded ice. Grounded ice at such depths and the presence of tills extending to the shelf edge indicate major glacial episodes. An extensive lateral moraine that flanks the southern edge of the saddle suggests that an ice tongue filled the saddle. In the deepest part of the saddle, high-resolution seismic records across a core site obtained earlier by Vilks show the core penetrates the upper part of a postglacial stratified silt sequence overlying glacial till. Extrapolating the ^{14}C date obtained by Vilks from a sediment core suggests the minimum date for the underlying till is approximately 70000 years BP. Thus there is no indication of the late Wisconsinan till in the area. (11 refs.)

73843 Hudson Bay river sediments and regional glaciation. I. Iron and carbonate dispersal trains southwest of Hudson and James Bays. J.D.Adshead (Terrain Sci. Div., Geological Survey of Canada, Ottawa, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.290-304 (Feb. 1983).
Sands deposited from rivers draining the southwesterly trending watershed of the Cape Henrietta Maria area are enriched in calcite and are characterized by higher calcite/dolomite ratios than the sands from rivers north and south of the cape. This pattern suggests that a train of drift with distinctive carbonate composition extends southwest of Cape Henrietta Maria, indicating a dominant pattern of southwesterly ice flow in this region. Iron contents are highest for sands from rivers on Cape Henrietta Maria, suggesting iron enrichment in the sand fraction of tills in the cape area, and the existence of a broad dispersal train extending southwest of the cape. The dispersal train inferred from the calcite/dolomite ratios overprints part, but not all, of the dispersal train inferred from the iron content. (53 refs.)

73844 Hudson Bay river sediments and regional glaciation. III. Implications of mineralogical studies for Wisconsinan and earlier ice-flow patterns. J.D.Adshead (Terrain Sci. Div., Geological Survey of Canada, Ottawa, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.2, p.313-21 (Feb. 1983).
For pt.II see ibid., vol.20, no.2, p.305-12 (1983). Mineralogical studies of river sediments from the Hudson Bay and James Bay Lowlands suggest that the glacial erosion of pre-Devonian Paleozoic carbonate rocks played an important role in the production of calcite-enriched debris in the Cape Henrietta Maria watershed. Ice flowing southwesterly across Devonian basins in western Hudson Bay and the James Bay Lowlands would largely bypass the intervening cape area. Enrichment of iron in river sands of the cape watershed is attributed to Proterozoic ferruginous sources now largely submerged under the waters of eastern Hudson Bay. Distributional patterns of carbonates and iron indicate that the dominant flow of ice from eastern Hudson Bay was southwesterly toward Cape Henrietta Maria, without major flow from the area of Proterozoic bedrock into the Nelson River watershed. In the cape area, iron enrichment due to Proterozoic sources significantly overshadows possible contributions from siderite-bearing Devonian bedrock. The fluvial sediment data are consistent with a multiple dome model of glaciation with ice mass centres located east and west of Hudson Bay. However, quartz/(total carbonate) ratios indicate that, if independent ice masses existed in this configuration, the dominant position of their contact should be placed north of the Churchill-Nelson watershed boundary. Indications of K-feldspar enrichment in Churchill sands are not evident in cap localities where ice flow was southwesterly. Rivers sands are composite channel samples of a drift cover that includes several pre-Wisconsinan tills as well as Wisconsinan deposits. Well defined regional patterns of composite (fluvial) sediment composition suggest a consistency in dominant regional ice movements through time. Similarities between regional drift dispersal limits based on these composite sediments and on pebble dispersal patterns for Wisconsinan tills further indicate that dominant ice-flow patterns in central Canada were probably similar for Wisconsinan and earlier glaciations. (30 refs.)

73845 Late Quaternary glacial history of the hermitage area of southern Newfoundland. D.A.Leckie, S.B.McCann (Dept. of Geography, McMaster Univ., Hamilton, Ontario, Canada).
Can. J. Earth Sci. (Canada), vol.20, no.3, p.399-408 (March 1983).
During Late Wisconsinan glaciation, the northern part of the Hermitage area was glaciated by Newfoundland-centred ice and the southern part by a small, complex, upland ice field, broken by nunataks. During deglaciation a lobe of Newfoundland ice dammed a lake at the head of Bay d'Espoir in which a series of small glaciolacustrine deltas were deposited. Valley glaciers from the southern ice cap reached the south coast at several locations, most notably near Harbour Breton, where a large glaciomarine delta was formed during deglaciation when sea level stood 22-24 m above present HWM. Except for three occurrences of till, no deposits were found that can be attributed to glacial events older than Late Wisconsinan. (18 refs.)

73846 Theory of the development of geothermal systems charged by vertical faults. G.S.Bodvarsson, S.M.Benson, P.A.Witherspoon (Earth Sci. Div., Lawrence Berkeley Lab., Berkeley, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9317-28 (10 Nov. 1982). [received: May 1983]
A two-dimensional model of fault-charged hydrothermal systems has been developed that considers the transient development of such systems including the effects of heat losses to the confining layers. The model can be used for theoretical studies of the development of fault-charged reservoirs. It can also be used to estimate the rate of recharge from the fault source and the time of evolution, using temperature data from wells. The model has been applied to the hydrothermal system at Susanville, California. A reasonable match with the areal temperature distribution in the primary aquifer and the temperature profiles of individual wells was obtained. This allowed an estimate of the recharge rate from the fault into the hydrothermal system to be obtained, a threefold increase in the capacity of this system was indicated. (14 refs.)

73847 On fluid reserves and the production of superheated steam from fractured, vapor-dominated geothermal reservoirs. K.Pruess, T.N.Narasimhan (Earth Sci. Div., Lawrence Berkeley Lab., Berkeley, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9329-39 (10 Nov. 1982). [received: May 1983]
Vapor-dominated geothermal reservoirs produce saturated or superheated steam, and vertical pressure gradients are close to vapor static. These observations have been generally accepted as providing conclusive evidence that the liquid saturate must be rather small ($<$50%) in order that liquid may be nearly immobile. This conclusion ignores the crucial role of conductive heat transfer mechanisms in fractured reservoirs for vaporizing liquid flowing under two-phase conditions. The authors developed a multiple interacting continuum method (MINC) for numerically simulating two-phase flow of a

homogeneous fluid in a fractured porous medium. Application of this method to reservoir conditions representative of The Geysers, California, and results from an analytical approximation show that, for matrix permeability less than a critical value (≈2.5 to 5 microdarcies), the mass flux of water from the matrix to the fractures will be continuously vaporized by heat transported due to conduction. This gives rise to production of superheated steam even when the matrix has nearly full liquid saturation. (29 refs.)

73848 A time-dependent ice sheet model: preliminary results. R.A.Bindschadler (Goddard Lab. for Atmospheric Sci., NASA Goddard Space Flight Centre, Greenbelt, MD, USA), R.Gore.
J. Geophys. Res. (USA), vol.87, no.C12, p.9675-85 (20 Nov. 1982). [received: May 1983]
A numerical model of ice sheet flow is developed. This model includes vertical resolution of temperature, stress, and strain rate. The model follows the flow of ice along a flow line within an ice sheet drainage basin. Longitudinal stresses and basal sliding are included. Basal sliding is dependent on the base shear stress and a specified distribution of basal water pressure. The numerical methods used to solve the coupled set of stress and velocity equations for the static and time-evolutionary cases are discussed. A steady state profile simulating an ice stream is calculated for a particular set of input parameters, and changes in the profile are examined for different choices of parameters. Preliminary studies of response behaviour are completed using a simplified ice sheet geometry with a fixed terminus or grounding line. Results of these studies illustrate ice sheet thinning in response to a lowered sea level or to a reduction in the extent of ice rises (or pinning points) within ice shelves. (34 refs.)

73849 Sidescan sonar recognition of subaqueous landforms in Loch Earn, Scotland. J.McManus, R.W.Duck (Dept. of Geology, Univ. of Dundee, Dundee, Scotland).
Nature (GB), vol.303, no.5913, p.161-2 (12 May 1983).
Cores obtained during sedimentological studies of British lakes reveal the presence of disturbed layering in slope face and slope foot areas, but undisturbed materials on areas of flat floor. Smith and others have suggested that these features may be due to slumping of the unconsolidated deposits. The abundance of slumping indicated by cores in many lake basins suggested that slope failure and land slipping are very widespread. The authors report that sidescan sonar surveys of the slopes of Loch Earn, Scotland, show the presence of over 100 examples of subaqueous slumps which appear to fall into three morphological types. Pinger surveys confirm sediment thickness variations, supporting suggestions of sliding in such areas. (9 refs.)

73850 Spring snow melting and evaporation of snow in central Yakutia. A.L.Are, M.S.Petropavlovskaya (Inst. of Geocryology, Acad. of Sci., USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.72-6 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.91-6 (1982).
Discusses field observations of snow melting in 1978-1980 and evaporation from the snow in 1969-1980 at a permanent heat-balance station of the Institute of Geocryology of the USSR Academy of Sciences Siberian Division (in the vicinity of Yakutsk). Daily values are given for the snow-melting and evaporation rates, as well as melting coefficients and empirical relationships for the snow-melting rate as a function of air temperature and melting type. (5 refs.)

73851 Description of river runoff at several sites by the multivariate canonical expansion method. I.V.Busalaev, S.K.Davletgaliev (Kazakh State Univ., Kazakh SSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.62-7 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.81-7 (1982).
A method of modeling the discharge hydrograph based on multivariate canonical expansion of vector random functions is examined. It permits one to obtain realizations of the monthly values of runoff simultaneously at several discharge sites with consideration of auto- and cross-correlation functions. A check of the proposed method, for the example of the inflows of water to the Bukhtarma and Shul'ba reservoirs, shows a satisfactory accuracy for the model. (10 refs.)

Sea Level Ice and Climatic Change. Proceedings of a Symposium .... See Entry 69794

Thermal aspects of radioactive waste burial in hard rock .... See Entry 70651

The role of waste conditioning as regards the safety of low-and intermediate-level waste disposal .... See Entry 70684

Considerations for waste conditioning associated with near-field phenomena and geochemical processes in a geological disposal environment .... See Entry 70686

Development of sphene-based glass ceramics tailored for Canadian waste disposal conditions .... See Entry 70700

Determination of trace amounts of phosphate in river water by flow-injection analysis .... See Entry 73391

Change in the ice and thermal regime of the Vilyui river in the lower pool of the Vilyui I-II hydrostation .... See Entry 73403

Nuclear waste repository characterization: a spatial estimation/identification approach .... See Entry 73501

Permafrost, heat flow, and the geothermal regime at Prudhoe Bay, Alaska .... See Entry 73762

Hudson Bay river sediments and regional glaciation. II. Comparison of carbonate mineralogy of size fractions for ice movement inference .. See Entry 73782

Settling velocity distribution of natural aggregates .... See Entry 73787

Elastic moduli, thermal expansion, and inferred permeability of two granites to 350°C and 55 megapascals .... See Entry 73791

Discovery of striated calcareous concretions in the Gentilly Till of Saint Laurent, Quebec .... See Entry 73797

Evolution of liquid and solid discharges of a sub-boreal estuary: St. Jean river, Quebec (north coast of Gulf of St. Lawrence) .... See Entry 73803

Criteria characterizing flows of liquids with stable stratification .... See Entry 73835

Models of univariate and joint distributions of nonnegative random variables .... See Entry 73900

On climatic changes due to a deliberate flooding of the Qattara depression (Egypt) .... See Entry 73906

Seismological station of the Institute of Geophysics, Polish Academy of Sciences, in the Hornsund Fiord, Spitsbergen .... See Entry 73926

Analytical nonmetric close-range photogrammetry for monitoring stream channel erosion .... See Entry 73949

Relict drainages, conical hills, and the eolian veneer in southwest Egypt—applications to Mars .... See Entry 74025

92.60 METEOROLOGY

(see also 43.28 Aeroacoustics and atmospheric sound)

73852 Data on total and spectral solar irradiance. A.T.Mecherikunnel, J.A.Gatlin, J.C.Richmond (NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Appl. Opt. (USA), vol.22, no.9, p.1354-9 (1 May 1983).
This paper presents a brief survey on the data available on solar constant and extraterrestrial solar spectral irradiance. The spectral distribution of solar radiation at ground surface, computed from extraterrestrial solar spectral irradiance for several air mass values and for four levels of atmospheric pollution is also presented. The total irradiance at ground level is obtained by integration of the area under the spectral irradiance curves. It is significant that, as air mass increases or as turbidity increases, the amount of energy in the infrared relative to the total increases and that the energy in the UV and visible decreases. (44 refs.)

73853 Periodicity of variations in the annual precipitation totals in Poland. K.Kozuchowski (Dept. of Meteorology, Climatology & Hydrology, Lodz Univ., Lodz, Poland).
Acta Geophys. Pol. (Poland), vol.30, no.3, p.287-92 (1982).
Discusses investigations based on the annual precipitation totals in Poland for the period 1931-80, obtained from 38 meteorological stations. Fuhrich's autocorrelation method is used and the period of oscillations of the chronological series is determined. It is found that in most of the country precipitation displays a 2-3 year period of oscillation. This result is similar to that of Suryjak (1974) who found a quasi-two-year periodicity for precipitation variations in northern and central Poland, as well as the relationship between precipitation and the date of the spring reversal of winds in the stratosphere. (6 refs.)

73854 Sodar and tower studies of the atmospheric structures near the sea coast. S.K.Aggarwal, S.P.Singal (Nat. Phys. Lab., New Delhi, India), R.K.Kapoor, B.B.Adiga.
J. Acoust. Soc. India, vol.9, no.2, p.28-38 (April 1981). [received: March 1983]
Simultaneous observations made by acoustic sounder and a meteorological tower during the month of May 1978 of the lower atmosphere at the Atomic Power Station Tarapur are reported. The probing range of the acoustic sounder was 700 metres. The meteorological tower could sense wind and temperature parameters at various levels up to a range of 120 metres. The site being close to the sea shore, the thermal atmosphere of the lower atmosphere is controlled mostly by land and sea breeze circulation. Thermal convective structure is seen during the day time and also during the night time. The frequency of plume formation and the height of the plumes is, however, low during the night time. The convective boundary layer during day time ranges from 400 m-500 m while during the night time it is mostly under 200 m. The observation of thermals during the night is explained due to the presence of a neutrally stable marine layer above 30 m height at this site. (11 refs.)

73855 Experimental study of the boundary layer over moderate relief near a mountain chain. III. Turbulent structure of the convective boundary layer at low levels analysed by Doppler sodar. G.Dubosclard (Obs. de Phys., Globe du Puy de Dome, Clermont Ferrand, France), B.Benech, J.Noilhan, A.Druilhet.
Boundary-Layer Meteorol. (Netherlands), vol.25, no.2, p.107-19 (Feb. 1983). In French.
For pt.II see ibid., vol.25, no.1, p.3-16 (1983). Doppler sodar derived values of the temperature structure parameter ${C_T}^2$, the vertical velocity variance w'^2, and the rate of dissipation of turbulent energy ϵ, were measured during unstable conditions above the Lannemezan heterogeneous site. The vertical profiles of these turbulent parameters, normalized by the classical convective scales are compared with those obtained using the same acoustic sounder above an homogeneous site during convective conditions. The typical decrease of ${C_T}^2$ as $Z^{-4/3}$ is partially verified on the heterogeneous site: for the lower levels, ${C_T}^2$ exhibits an increase with Z whereas for the intermediate levels ${C_T}^2$ decreases as $Z^{-4/3}$. For the upper levels, ${C_T}^2$ increases with Z due to a signal-to-noise ratio lower than 1. The vertical profiles of w'^2 above the two sites are rather similar. However, near the base of the convective inversion Z_i, the values measured on the heterogeneous site are more scattered. (21 refs.)

73856 Modelling the height, temperature and relative humidity of a well-mixed planetary boundary layer over a water surface. H.Okland (Inst. for Geophys., Univ. of Oslo, Oslo, Norway).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.2, p.121-41 (Feb. 1983).
A vertically integrated model of a developing boundary layer over a wet surface is presented, and the expected change in the relative humidity is discussed. For the case of cold air moving over a water surface of constant temperature, analytical solutions of the model equations are obtained, giving the height, temperature and relative humidity of the boundary layer as functions of the distance travelled by the air column. The relation to the problem of sea smoke is discussed. (13 refs.)

73857 Convective plumes in the atmospheric boundary layer as observed with an acoustic Doppler sodar. O.Taconet, A.Weill (CNET, CRPE, Issy-Les-Moulineaux, France).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.2, p.143-58 (Feb. 1983).
The vertical velocity field and the convective plumes in the atmospheric boundary layer have been observed during morning hours with the acoustic Doppler sounder of the CRPE. A method for plume determination using acoustic soundings in the well-mixed layer is presented. Using Telford's 1970 and Manton's 1975 models, a comparison is made between the predictions of the models and the plume properties as observed by the Doppler sodar. The mean plume velocity is found to be parabolic. It is shown, restricting Monin and Obukhov similarity to conditions inside plumes and using only vertical velocity within plumes, that the observed convective plumes carry nearly sixty percent of the sensible heat flux at the top of the surface layer. (22 refs.)

73858 An interpolation method of randomly distributed atmospheric data in the height-time domain. F.Trombetti, F.Tampieri (Istituto FISBAT CNR, Bologna, Italy).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.2, p.159-70 (Feb. 1983).
A numerical method for objective interpolation of boundary-layer data in the height-time domain is presented. The method is based on a diffusive transport hypothesis and allows for the determination of the optimal ratio between the height and time scales to be used for non-dimensionalising the independent variables z and t. This ratio, with dimensions of a velocity, may be related to the vertical transfer properties of the atmosphere. A few cases during springtime with different stability conditions are discussed, showing that this ratio varies by at least one order of magnitude between day and night. (12 refs.)

73859 Modulation of heat flux by different scales of advection in an urban environment. J.K.S.Ching, J.F.Clarke, J.M.Godowitch (Environmental Sci. Res. Lab., Environmental Protection Agency, Research Triangle Park, NC, USA).

Boundary-Layer Meteorol. (Netherlands), vol.25, no.2, p.171-91 (Feb. 1983).

Sensible heat flux data obtained from the US Environmental Protection Agency's Regional Air Pollution Study in St. Louis, Missouri are presented and discussed. Large spatial variations exist in heat flux on both a land-use scale and the urban scale. Arguments based upon empirical data and sampling theory show that estimates of heat flux representative of an upwind fetch l_x require a minimum observation height proportional to $z^{3/4}$. The influence of advection on the magnitude of the heat flux is also explored for both the urban and sub-urban or land-use scales. The data clearly indicate that advection can strongly modulate and even dominate the vertical heat flux above surfaces in areas which maintain large horizontal temperature gradients. (16 refs.)

73860 Wind profiles over complex terrain. Zhao Ming, H.A.Panofsky (Dept. of Meteorology, Pennsylvania State Univ., University Park, PA, USA), R.Ball.

Boundary-Layer Meteorol. (Netherlands), vol.25, no.3, p.221-8 (March 1983).

A large set of routine wind profiles has been analyzed at three towers, located in various types of complex terrain in New England. After allowing for effects of roughness change, uphill flow and stability, roughness lengths have been estimated. In general, the profiles and roughness lengths could be explained by differences in terrain features and stability. (15 refs.)

73861 Dissipation length in stable layers. J.F.Louis, A.Weill, D.Vidal-Madjar (CNET/CRPE/CNRS, Issy-les-Moulineaux, France).

Boundary-Layer Meteorol. (Netherlands), vol.25, no.3, p.229-43 (March 1983).

An attempt is made, for an anticyclonic stable situation in the atmospheric boundary layer during November 1978, to estimate the dissipation length. The turbulent dissipation and the turbulent kinetic energy, as measured on a 100 m high mast, exhibit large variability, due to the sporadic turbulent structure of the stable layer, and associated variability of the Richardson number. A comparison with different parameterizations of the turbulent dissipation rate allows a validation of these parameterizations. (30 refs.)

73862 Turbulent characteristics of a shallow convective internal boundary layer. A.-S.Smedman, U.Hogstrom (Dept. of Meteorology, Univ. of Uppsala, Uppsala, Sweden).

Boundary-Layer Meteorol. (Netherlands), vol.25, no.3, p.271-87 (March 1983).

Turbulent characteristics of a 50 to 100 m deep convective internal boundary layer are studied. The data were gathered at a flat coastal site (Nasudden on the island of Gotland, Sweden) during three consecutive days in May 1980 which were characterized by a steady, very stable stratified marine approach flow. The site is situated on a flat area ca. 1500 m from the shoreline. Only daytime runs have been analysed. The analysis shows that the turbulent regime has a mixed character. (15 refs.)

73863 A one-dimensional simulation of the stratocumulus-capped mixed layer. Chaing Chen, W.R.Cotton (Dept. of Atmospheric Sci., Colorado State Univ., Fort Collins, CO, USA).

Boundary-Layer Meteorol. (Netherlands), vol.25, no.3, p.289-321 (March 1983).

A marine stratocumulus model has been developed which has four major sub-models: (1) a one-dimensional version of the CSU cumulus model, (2) a partially-diagnostic higher-order turbulence model, (3) an atmospheric radiation model for both short-wave and long-wave radiation, and (4) a partial condensation scheme and cloud fractional parameterization. A set of numerical experiments have been performed to study the interactions among the turbulence, the long-wave radiation, the short-wave radiation, and the sub-grid condensation processes. (32 refs.)

73864 Ozone measurements from a network of remote sites. G.Evans, P.Finkelstein, B.Martin, N.Possiel (US Environmental Protection Agency, Research Triangle Park, NC, USA), M.Graves.

J. Air Pollut. Control Assoc. (USA), vol.33, no.4, p.291-6 (April 1983).

National Air Pollution Background Network O_3 data for 1979 are examined, relationships with on-site meteorological measurements are explored, and possible influences from synoptic-scale air mass movements are investigated. (6 refs.)

73865 On the correctness as a whole of boundary-value problems for models of the dynamics of the atmosphere and ocean. V.I.Sukhonosov.

Dokl. Akad. Nauk SSSR, vol.269, no.3, p.556-60 (1983). In Russian.

The global solvability of the fundamental boundary-value problems for the systems of equations for the dynamics of atmospheric processes and for the dynamics of a baroclinic ocean, assuming a uniqueness theorem holds, is established. (11 refs.) *F.Q.*

73866 Characterisation of the 50-70 GHz band for space communications. E.Damosso, L.Stola (Centro Studi e Lab. Telecommunicazioni SpA, Turin, Italy), G.Brussaard.

ESA J. (Netherlands), vol.7, no.1, p.25-43 (1983).

The propagation characteristics of the 60 GHz oxygen absorption band have been studied, using the most up-to-date information in order to obtain adequate models for the transfer characteristics of the Earth's atmosphere at these frequencies. The dependence on height and the variations with climatic conditions are investigated. The results are used to study the limitations and feasibility of the application of different types of satellite communications in the 50-70 GHz frequency band. (17 refs.)

73867 Statistical properties of the dual-polarization differential reflectivity (Z_{DR}) radar signal. V.N.Bringi (Dept. of Electrical Engng., Colorado State Univ., Ft. Collins, CO, USA), T.A.Seliga, S.M.Cherry.

IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.215-20 (April 1983).

The statistical characteristics of three estimators of the differential reflectivity (Z_{DR}) radar signal are examined theoretically and compared with pulse-to-pulse measurements of reflectivity at horizontal and vertical polarizations. The square-law and log-ratio estimators provide satisfactory means for measuring Z_{DR} while the log-ratio estimator does not. In addition, the theory is consistent with radar data, clearly showing that Z_{DR} could be measured accurately from a sequence of alternately polarized waves. (17 refs.)

73868 The composition of precipitation in remote areas of the World. J.N.Galloway (Dept. of Environmental Sci., Univ. of Virginia, Charlottesville, VA, USA), G.E.Likens, W.C.Keene, J.M.Miller.

J. Geophys. Res. (USA), vol.87, no.C11, p.8771-86 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

The Global Precipitation Chemistry Project collects precipitation by event to determine composition and processes controlling it in five remote areas. Compositions (excluding seasalt) at St. Georges, Bermuda, were primarily controlled by anthropogenic processes; compositions and acidities at San Carlos, Venezuela, Katherine, Australia, Poker Flat, Alaska, and Amsterdam Island were controlled by unknown mixtures of natural or anthropogenic processes. Precipitation was acidic; average volume-weighted pH values are presented. Acidities at Bermuda and Alaska were from long-range transport to sulfate aerosol; at Venezuela, Australia, and Amsterdam Island, from mixtures of weak organic and strong mineral acids, primarily H_2SO_4. Relative proportions of weak to strong acids were largest at Venezuela and lowest at Amsterdam Island. Once contributions from human activities were removed, the lower limit of natural contributions was probably $\geq$pH 5. (49 refs.)

73869 The flux of dimethylsulfide from the oceans to the atmosphere. W.R.Barnard, M.O.Andreae, W.E.Watkins (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA), H.Bingemer, H.-W.Georgii.

J. Geophys. Res. (USA), vol.87, no.C11, p.8787-93 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

The role of biogenic dimethylsulfide from the ocean surface as a source of atmospheric sulfur is studied. On a cruise of the R/V Meteor across the Atlantic from Hamburg to Montevideo, Uruguay, the authors sampled the surface ocean at short intervals and analyzed over 300 seawater samples aboard ship. Simultaneously, the atmospheric concentration of DMS has been measured. Biological and chemical oceanographic data have been collected during the cruise to aid in the interpretation of the findings on DMS. The highest concentrations of DMS were found in productive regions on the continental shelves, in marginal seas and in some estuaries. The concentrations of DMS in the atmosphere ranged from 2 to 44 ng S(DMS)/m^3. The mean concentration is significantly lower than postulated concentrations of 40-200 ng S(DMS)/m^3 for marine background atmosphere, thus questioning the rates and mechanisms given for reactions of DMS in this environment. (27 refs.)

73870 Exchange of sulfur between the free troposphere, marine boundary layer, and the sea surface. M.A.Kritz (Space Sci. Div., NASA Ames Res. Center, Moffett Field, CA, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8795-803 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

A steady state analysis has been made of the sources and sinks of sulphur in the remote marine atmosphere and of the steady state exchanges of SO_2 and (excess) sulfate between the sea, boundary layer, and free troposphere. Two situations were examined: an area of high biological productivity (Gulf of Guinea) and an area of low productivity (tropical Atlantic). The results of the analysis suggest that about one-third of the 'background' concentrations of SO_2 and excess sulfate observed in the remote marine atmosphere mixes in from the free troposphere, with the balance, $\sim$100 μg S m^{-2} d^{-1}, attributed to the local oxidation of reduced sulfur-bearing precursors in the boundary layer. (60 refs.)

73871 Chemical analysis of cloud water collected over Hawaii. F.Parungo, C.Nagamoto, I.Nolt, M.Dias, E.Nickerson (NOAA, Boulder, CO, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8805-10 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

Two types of cloud water collectors were developed, and the devices were used to collect samples around the Hawaii Islands. The chemical analyses of cloud water showed that Na^+, Cl^-, and SO_4^{2-} ion concentrations were approximately 10^{-4} m; NH_4^+, NO_3^-, and Ca^{++} were 1 order of magnitude lower. The pH values were in the range of 4-5 regardless of sampling locations. The high acidity of cloud water over Hawaii may originate in the ocean or from long-range transport of anthropogenic pollution, in addition to local pollution, if present. (13 refs.)

73872 Clouds and wet removal as causes of variability in the trace-gas composition of the marine troposphere. A.M.Thompson, R.J.Cicerone (Scripps Inst. of Oceanography, Univ. of California, San Diego, CA, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8811-26 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

Describes a modeling study of the effects of clouds and wet removal on the chemistry of the remote marine troposphere. Using a time-dependent model with parameterized vertical transport to calculate trace-gas concentrations, it was that large variations in key species (e.g. HNO_3, H_2CO, and H_2O_2) result from simulations of sporadic rainfall, changes in cloud cover, and external inputs such as surface NO sources. Depending on the frequency and intensity of an event, the effects of these perturbations may persist for several days. Long-term integrations with fixed boundary conditions and regularly occurring cloud and rain episodes demonstrate a strong sensitivity of the mean concentration of longer-lived soluble gases to precipitation frequency but also confirm the validity of using properly chosen parameterizations of wet removal in steady state calculations. (58 refs.)

73873 Air-sea exchange of CO_2 and evidence for enhanced upward fluxes. M.L.Wesely, D.R.Cook, R.L.Hart, R.M.Williams (Radiological & Environmental Res. Div., Argonne Nat. Lab., Argonne, IL, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8827-32 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

The flux of carbon dioxide has been measured by eddy correlation techniques over shallow coastal waters at an outer submerged reef near Miami, Florida, during two weeks in March when the seawater was gradually warming. Large upward fluxes were detected, much larger than expected, and they were nearly linearly proportional to friction velocity u_* for the wind speeds of 3-10 m s^{-1} encountered. In 10 m s^{-1} winds, the flux was 0.30-0.35 mg m^{-2} s^{-1} and the aqueous transfer velocity across the interfacial sublayer was about 0.20 cm s^{-1}. The measured eddy fluxes of submicron particles were also directed upward and displayed a strong, nearly linear dependence on u_* similar to the case for CO_2. Bubbles could be a source of increased CO_2 transport. (22 refs.)

73874 Measurements of ozone vertical flux to ocean and forest. D.H.Lenschow (Nat. Center for Atmospheric Res., Boulder, CO, USA), R.Pearson,Jr., B.B.Stankov.

J. Geophys. Res. (USA), vol.87, no.C11, p.8833-7 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

Ozone flux has been measured from aircraft by the eddy correlation technique over the Gulf of Mexico, the north Pacific Ocean, and a Gulf Coast pine forest. Measurements over the Gulf were obtained in polluted air (which had flowed down the Mississippi valley) over relatively warm water, while the north Pacific observations were obtained in pristine air over relatively cold water with nearly neutral stratification. Values of the surface resistance to ozone were about 1.8×10^3 s m^{-1} over both ocean surfaces and 50 s m^{-1} over the forest, with an accuracy of better than $\pm$15%. Photochemical production of ozone during midmorning with clear skies over the Gulf of Mexico was 0.2-0.3 ng m^{-3} s^{-1}. (20 refs.)

73875 **Magnitudes and sources of precipitation and dry deposition fluxes of industrial and natural leads to the North Pacific at Enewetak.** D.M.Settle, C.C.Patterson (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8857-69 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

A total atmospheric Pb input flux of 7 ng Pb cm^{-2} yr^{-1} was measured in the North Pacific Easterlies at Enewetak. Parameters used to measure this flux were ratio of dry deposition flux to precipitation flux; Pb/^{210}Pb in precipitation and seawater; ^{210}Pb flux; washout factor; and Pb concentrations in air, rain, and dry deposition deposits. Relations among these parameters established at Enewetak were used to recompute and confirm previous estimates of lead fluxes to the oceans (ng Pb cm^{-2} yr^{-1}) at the following locations: North Atlantic Westerlies, 170; North Pacific Westerlies, 50; and South Pacific Easterlies, 3. Prehistoric lead output fluxes to sediments at these locations are described. The relative importance of natural pollution sources is deduced. Seasonal depositional variations were studied. (52 refs.)

73876 **Sporadic transport and deposition of continental aerosols to the Pacific Ocean.** S.Tsunogai, T.Kondo (Dept. of Chem., Hokkaido Univ., Hakodate, Japan).

J. Geophys. Res. (USA), vol.87, no.C11, p.8870-4 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

Aerosol samples were collected in the surface air over the North Pacific onboard a vessel in May and June 1980 and were analyzed for Na, Al, Fe, Mn, and ^{210}Pb. The concentration ratios of Fe/Al and Mn/Al are similar to those of crustal material. The concentration of Al in the maritime surface air was usually observed to be 30-50 ng/m^3. On June 9, however, an extremely high concentration of 670 ng/m^3 of Al was observed at 30°N, 161°E. The Al concentration is still insufficient to explain the accumulation rate of aluminosilicate in the pelagic sediment if the deposition velocity is 1 cm/s, but the nature of the 'Kosa' particles is possible to explain it, even though the dust particles are sporadically transported. (16 refs.)

73877 **Marine aerosol chemistry at Cape Grim, Tasmania, and Townsville, Queensland.** M.O.Andreae (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8875-85 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

During September 1979, aerosol samples were collected at two coastal sites, Cape Grim, Tasmania, in the southern temperate latitudes, and Townsville, Queensland, in the subtropical region. The samples were analyzed for the light elements ($6 \leq Z \leq 19$) by proton elastic scattering analysis (PESA) and for the heavier elements ($Z \geq 12$) by PIXE. As anthropogenic and continental influences are essentially nonexistent along the track of air-masses for several days before they reach Cape Grim, this site is ideally suited for the study of purely marine air-masses. Sulfur at this site is dominated by seasalt, and the submicron sulfur particle mode universally encountered in the southern tropics and the northern hemisphere is almost not detectable here. Other element concentrations that were studied include Ca, Cl, C (both organic and as soot), N and K. (37 refs.)

73878 **Airborne ice nucleus measurements around the Hawaiian Islands.** R.C.Schnell (Cooperative Inst. for Res. in Environmental Sci., Univ. of Colorado, Boulder, CO, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8886-90 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

Atmospheric ice nucleus and aerosol samples were collected with an aircraft at various altitudes over the ocean upwind of the Hawaiian Islands on four days in June 1980. Below the subtropical trade wind inversion, ice nucleus activity was detectable at −10°C in concentrations of $1l^{-1}$ active at −12°C. Above the inversion, threshold activity decreased to −15°C and colder. Ice nucleus concentrations were about 10^{-5} of the number of aerosol particles at all levels. (25 refs.)

73879 **Nonsteady state simulations of the global mercury cycle.** G.E.Millward (Dept. of Marine Sci., Plymouth Polytech., Plymouth, England).

J. Geophys. Res. (USA), vol.87, no.C11, p.8891-7 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

A time-dependent global cycling model consisting of five reservoirs has been developed to examine the effects of the anthropogenic mobilization of mercury. An unpolluted steady state was perturbed by allowing the mercury efflux from the land to the atmosphere to increase with time, in line with trends implied from mercury in Greenland ice cores and present day fluxes. The results showed that with a variety of initial conditions the atmospheric content increased by a factor of about 6 with a maximum concentration occurring some 700 years after the perturbation. The ocean surface increased by about 50% over the same time scale and both these biologically important reservoirs relaxed to new steady states in about 4000 years. The sensitivity of the model to changes in some of the important rates was investigated. (28 refs.)

73880 **Whitecap aerosol productivity deduced from simulation tank measurements.** E.C.Monahan, K.L.Davidson (Dept. of Meteorology, Naval Postgraduate School, Monterey, CA, USA), D.E.Spiel.

J. Geophys. Res. (USA), vol.87, no.C11, p.8898-904 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

An estimate of dF_0/dr; the sea spray aerosol production per increment droplet radius per unit time per unit area of the ocean, has recently been obtained from a term-by-term evaluation of the following expression: $dF_0/dr = dE/dr\tau^{-1}W(U)$. The differential whitecap aerosol productivity, dE/rr, the number of aerosol droplets per increment droplet radius produced during the decay of a unit area of whitecap, has been redetermined, for the size range 0.8 $\mu m < r < 8$ μm, from the results of recent experiments in the University College, Galway, whitecap simulation tank in which Particle Measuring Systems aerosol spectrometers were used. The characteristic decay time for whitecaps, τ, and the initial whitecap area were in the present study determined from the frame-by-frame analysis of cine-film recordings of whitecaps generated in the simulation tank. (26 refs.)

73881 **Sea spray: a further look.** Jin Wu (Coll. of Marine Studies, Univ. of Delaware, Newark, DE, USA).

J. Geophys. Res. (USA), vol.87, no.C11, p.8905-12 (20 Oct. 1982). [received: May 1983] (Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC), Hamburg, Germany, 24-27 Aug. 1982).

Earlier laboratory and oceanic results on parametric descriptions of concentrations and sizes of spray droplets are critically compared. This summary also encompasses mechanism of spray production, conditions of spray inception, and various distributions of droplets in both laboratory tanks and the field. These results are then used, along with further analyzed calculations of droplet motion in the turbulent surface layer, to relate sea spray to other oceanographic phenomena. (32 refs.)

73882 **A model for the relationships between precipitation D/H ratios and precipitation intensity.** C.J.Yapp (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA).

J. Geophys. Res. (USA), vol.87, no.C12, p.9614-20 (20 Nov. 1982). [received: May 1983]

A simple quantitative model has been developed which predicts that a parametric correlation between the isotopic composition of precipitation and precipitation intensity can exist as a consequence of the condensation process when certain conditions are met. These conditions include the following: (1) approximate constancy, from one sampling interval to the next, of the initial isotopic composition of the water vapour in precipitation-producing air masses; (2) approximate constancy of the initial condensation temperature; (3) approximate constancy of the rate of vertical ascent of the precipitating air mass; and (4) approximate constancy of the ratio of condensed water to water vapour. Such conditions are probably rare in nature for the short collection intervals represented by existing samples. However, with the probable exception of condition 3, tropical oceanic islands may satisfy the preceding conditions on the month-to-month time scale for which precipitation samples have generally been collected for isotopic analysis. Precipitation samples from Wake and Johnston islands that plot on the meteoric water line were used to compare monthly δD values with corresponding precipitation intensity. The data for these two islands suggest that a simple precipitation δD versus intensity correlation is unlikely for monthly sample intervals. However, the issue remains unresolved for longer time scales. (20 refs.)

73883 **A study of atmospheric diffusion from the LANDSAT imagery.** Y.Viswanadham, J.A.Torsani (Inst. de Pesquisas Espaciais, Sao Paulo, Brazil).

J. Geophys. Res. (USA), vol.87, no.C12, p.9621-35 (20 Nov. 1982). [received: May 1983]

Detailed analyses of the LANDSAT multispectral scanner (MSS) data of the smoke plumes that originated in eastern Cabo Frio, Brazil (22°59′S; 42°02′W) and crossed over into the Atlantic ocean are presented to illustrate how high-resolution LANDSAT imagery can aid meteorologists in evaluating specific air pollution events. The eleven LANDSAT images selected are for different months and years. Conventional interpretation techniques are applied to analyse the images with a view to arriving at certain plume characteristics. The analysis of the visible smoke plumes revealed that the plume was 130 km long and attained a maximum width of 937 m, 10 km away from the chimney emitting the effluent. The results show that diffusion is governed primarily by water and air temperature differences. (59 refs.)

73884 **Winds between San Diego and San Clemente Island.** C.E.Dorman (Dept. of Geological Sci., San Diego State Univ., San Diego, CA, USA).

J. Geophys. Res. (USA), vol.87, no.C12, p.9636-46 (20 Nov. 1982). [received: May 1983]

Dense ship observations off San Diego were used to capture the diurnal and seasonal wind trends. The land breeze regime extends to 40 km off San Diego in the winter, but goes to less than 10 km when averaged for the winter. Significant diurnal variations in wind speed occur in all seasons from the coast to beyond 140 km. Ship observations were averaged over 0.2° of latitude and longitude. These have significant structure that is obscured in other studies based upon 1° averages. Wind speeds decrease by a factor of 2 or more from 140 km offshore to the coast in both the northerly and westerly component. The mean flow has a weak summer southerly component. This is in opposition to earlier studies. Ship observations were compared to San Diego Airport and San Clemente Island measurements in order to check the accuracy of allowing land measurements to substitute for over water measurements. San Diego winds were found to be very representative of the nearest 10 km of ocean in wind speed and direction on the diurnal and seasonal scales. (20 refs.)

73885 **Sensitivity of ozone retrievals in limb-viewing experiments to errors in line-width parameters.** M.A.H.Smith (NASA Langley Res. Center, Hampton, VA, USA), L.L.Gordley.

J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.413-18 (May 1983).

The variance of atmospheric ozone concentration profiles retrieved in IR limb-viewing experiments is examined over the range of published ozone half-width values. Simulated retrievals are performed for a typical satellite-based high-resolution absorption experiment and a broad-band emission experiment. The results indicate that, for limb-viewing experiments, inaccurate collision-broadened linewidth values can lead to significant errors in retrieved profiles for broad-band radiometric data or for isolated strong lines in high-resolution spectra. (17 refs.)

73886 **Effect of wind-generated waves on the transfer of solar radiation in the atmosphere-ocean system.** T.Nakajima, M.Tanaka (Upper Atmosphere Res. Lab., Tohoku Univ., Sendai, Japan).

J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.521-37 (June 1983).

Transfer of solar radiation in the combined atmosphere and ocean system is evaluated by the matrix operator method. Derivation of the reflection and transmission matrices required for applying the matrix method is discussed introducing the shadowing effect of light by the ocean waves. Spectral and total radiation fields just above and below the ocean surface, as well as the top of the atmosphere, are numerically calculated using several optical models of the atmosphere, ocean, and wind roughened ocean surface. Dependencies of radiance and flux reflectivity on the wind velocity and optical property of the ocean body are discussed in detail. (36 refs.)

73887 **N_2 broadening parameters of ozone at 9.6 μm.** J.S.Margolis (Jet Propulsion Lab., Pasadena, CA, USA).

J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.6, p.539-42 (June 1983).

The N_2 broadening parameters for approx. 150 lines of ozone (mainly ν_3 transitions) in the 9.6 μm region have been measured from spectra taken with 0.005 cm^{-1} resolution. (10 refs.)

73888 **A simple hourly clear-sky solar radiation model based on meteorological parameters.** J.E.Sherry, C.G.Justus (School of Geophys. Sci., Georgia Inst. of Technol., Atlanta, GA, USA).

Sol. Energy (USA), vol.30, no.5, p.425-31 (1983).

An hourly solar radiation model, based on observed meteorological data, was developed and tested. As a means of comparison, the Watt and Bird models and the Solmet regression models were also tested. Several conclusions were drawn about the parametrization of solar radiation-depleting parameters. It was determined that a reasonable estimate of lower layer aerosol extinction can be determined using humidity, visibility, and mixing height. The parametrization of water vapor absorption obtained by atmospheric rather than laboratory observations was found to give better model results. (13 refs.)

73889 Circumsolar radiation calculated for various atmospheric conditions. E.Thomalla, P.Kopke, H.Muller, H.Quenzel (Meteorologisches Inst., Univ. of Munich, Munchen, Germany).
Sol. Energy (USA), vol.30, no.6, p.575-87 (1983).
The circumsolar radiance and irradiance is discussed taking into account all relevant optical parameters. The decrease of the radiance from the limb of the Sun to an angular distance of 10° from the Sun's center is mainly determined by the optical depth of the atmosphere and the size distribution of scattering particles. Thin cirrus clouds have the strongest effect. In this case the radiance at 0.5° angular distance may reach about 2 per cent of the radiance of the direct Sun. In the case of aerosol scattering alone, the radiance at 0.5° does not reach more than 0.1 per cent. Therefore a field of view larger than the angular size of the Sun only gives rise to a significant increase in the total (solar plus circumsolar) irradiance if a thin cirrus layer is present. (21 refs.)

73890 Investigation of the stability of a regression scheme for forecasting the Northern Hemisphere H_{500} fields. V.A.Steblyanko, A.A.Burtsev (Hydrometeorological Sci. Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.11-17 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.17-25 (1982).
A regression scheme for forecasting the Northern Hemisphere H_{500} fields is used in an experimental study of scheme stability at the stage of selection of the most informative predictors; also investigated is the dependence of forecast quality on the volume of the sample from which the regression coefficients are calculated. The informative predictors are selected by screening in combination with a moving-control procedure. An algorithm based on the stochastic approximation procedure of Robbins-Monro is proposed for investigation of the asymptotic behavior of the parameters of the regression-coefficient vector. Estimates of forecast quality are given for selection of the predictors by the screening procedure alone and by the combination of that procedure with moving control. (7 refs.)

73891 Statistics of geopotential-forecast errors. A.M.Babaliev, V.V.Kostyukov (Karaganda State Univ., Karaganda, USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.18-23 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.26-32 (1982).
Certain statistical success properties of numerical forecasts in two operational models are presented. Problems of allowing for these properties with the object of improving the forecasts are discussed. (7 refs.)

73892 Vertical wind profile statistical control parameters. S.I.Gubanova, S.M.Olevskaya (Hydrometeorological Sci. Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.24-7 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.33-7 (1982).
Problems of statistical control of vertical wind profiles are discussed. Recent data on the vertical statistical structure of the wind field are used as a basis for computing control parameters for the zonal and meridional wind components—interpolation weights and theoretical interpolation errors for three latitude belts separately for the winter and summer seasons; the results of a numerical experiment with upper-air data are presented. (8 refs.)

73893 On the spatial structure of the horizontal atmospheric moisture flux. L.P.Kuznetsova, N.P.Chernova (Inst. of Water Problems, USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.28-32 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.38-44 (1982).
Certain statistical properties of the horizontal atmospheric moisture flux field over Western Siberia and Northern Kazakhstan are analyzed. The anisotropy of the moisture flux component fields and its relation to the atmospheric circulation are indicated. (9 refs.)

73894 Parameterization of ozone concentration fluctuations in the stratosphere. O.M.Pokrovskii, A.E.Kaigorodtsev (Main Geophys. Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.2, p.33-7 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.2, p.45-50 (1982).
The structure of the deviations of ozone concentration from the distribution governed by the mean meridional circulation is analyzed. It is shown that these deviations are determined largely by turbulence dynamics. The structure of the deviations due to ozone transport by stationary waves is determined. It is observed that this type of transport is related to the structural features of the zonal wind in the lower stratosphere. The structure of the empirical orthogonal fluctuations is studied for both the steady and the turbulent parts of the ozone-field fluctuations. (9 refs.)

73895 Variability of atmospheric temperature and circulation regimes of the Northern Hemisphere. G.V.Gruza, L.K.Kleshchenko, T.P.Timofeeva (All Union Res. Inst. of Hydrometeorological Information, USSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.1-10 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.8-20 (1982).
Various characteristics of the atmospheric temperature and circulation regimes are obtained on the basis of mean monthly data on air temperature at sea level, surface pressure, and 500-hPa surface geopotential during 1949-1979 for the Northern Hemisphere (30-80°N). The results of an analysis of the spatial and seasonal variability of these characteristics are given. The characteristics of the structure of their long-term variation, which is described by means of a polynomial trend, are examined. (22 refs.)

73896 Effect of temperature stratification on adiabatic oscillations in a polytropic atmosphere. O.K.Gorbunova, V.M.Kadyshnikov (Hydrometeorological Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.11-18 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.21-9 (1982).
The frequency spectrum of hydrothermodynamic equations linearized relative to the state of rest with a polytropic temperature distribution is investigated. An analysis of the dependence of frequencies and group velocities on the temperature lapse rate of this state and on the vertical variability of disturbances, characterized by the number of sign changes of their amplitudes, shows how with an increase of stability and decrease of variability the acoustic velocity of both types of disturbances in the atmosphere changes in this case. (4 refs.)

73897 Large temperature and precipitation anomalies in the territory of the European USSR Western Siberia, and Kazakhstan. O.V.Batyreva, L.E.Lukiyanova (Hydrometeorological Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.19-26 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.30-8 (1982).
A classification of growing seasons based on the ratio of the number of large positive and negative anomalies is given. A value of 1.2 σ is taken as the criterion of a large anomaly. Four classes of growing seasons are distinguished and an attempt is made to forecast these classes by means of linear discriminant analysis. Evaluations of the verification score of the classification exceed the evaluations of a random classification. (15 refs.)

73898 Interaction of subcloud and cloud layers in tropical cyclones and Intertropical Convergence Zone. E.A.Agrenich, A.P.Khain.
Sov. Meteorol. & Hydrol. (USA), no.3, p.27-32 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.39-44 (1982).
The following are determined by means of a somewhat modified Ogura-Cho (1974) method under the assumption of a steady state: the height of the mixed layer, temperature discontinuities, and mixing ratio at the Earth's surface and at the top of the mixed layer, and mass fluxes in cumulus clouds for tropical cyclones Daisy (1961), Hilda (1964), and Inez (1966) and average tropical cyclone, and also for disturbances of the I and III GATE phases. (8 refs.)

73899 Investigation of the dynamics of the cloud cover of the tropical zone by means of two-dimensional spectral analysis. A.V.Kislov (Moscow State Univ., Moscow, USSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.33-6 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.46-9 (1982).
The space-time variability of the cloud cover of the tropical zone is studied by means of two-dimensional spectral analysis (from satellite data). An extensive region between 5°N and 20°S encircling almost the entire globe (westward from the Greenwich meridian to 40°E) is selected as the region of investigations. For the equatorial and tropical zones disturbances of the easterly wave type, the period of which is 3 days and the length in a zonal direction is about 3000 km, proved to be characteristic. (11 refs.)

73900 Models of univariate and joint distributions of nonnegative random variables. A.S.Marchenko, A.G.Semochkin.
Sov. Meteorol. & Hydrol. (USA), no.3, p.37-42 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.50-6 (1982).
It is shown that a mixture of two gamma distribution permits approximating a wide class of distributions on the positive axis occurring in hydrometeorological practice. A method of estimating five parameters of the mixture on the basis of observation data is proposed. Models of time series with marginal distribution of this type are also examined. (7 refs.)

73901 Kinetic energy dissipation in a cyclone over the ocean. K.A.Rogachev.
Sov. Meteorol. & Hydrol. (USA), no.3, p.43-8 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.57-64 (1982).
Dissipation of the kinetic energy of wind in the marine surface boundary layer of a developing cyclone over the ocean as a function of the degree of development of wind waves is investigated on the basis of a model of the interaction of wind with waves. It is shown that the density of wind kinetic energy can increase severalfold during the day just due to a change in kinetic energy dissipation in the marine surface layer related to the generation of wind waves. (14 refs.)

73902 Use of ground generators of ice-forming aerosols in works on artificial enhancement of precipitation in mountain regions. A.G.Laktionov.
Sov. Meteorol. & Hydrol. (USA), no.3, p.68-73 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.88-93 (1982).
Calculations using a Gaussian model of diffusion of a passive admixture from generators located at a height of 1000 m are presented. The mixing conditions in the atmosphere correspond to Pasquill's weather types B, C, D. An assessment is given of the necessary output of each seeding site and distances between them to provide an effective seeding of supercooled clouds with ice nuclei, with the use of ground generators installed on a windward divide. (9 refs.)

73903 Studies of an extensive anticyclonic propagation event and of some short-term enhancements observed at VHF and UHF. R.G.Flavell.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.14-18 part 2
The paper begins by presenting a geographical analysis of 102 long-range 144 MHz amateur contacts, all verified, along distances of between 1100 km and 2944 km, made during a 24 hour period, 5/6 September 1981. Then follow examples of techniques which may be used to provide refractive index analyses of short-term enhancements of signal associated with weather fronts, structures of narrow horizontal extent which cannot be studied in detail using conventional cross sectional methods. The examples described reveal interesting details of the form of the features concerned. (4 refs.)

73904 The use of dual-linearly polarised radar data to determine rainstorm and hydrometeor types. E.L.Hines, M.J.Leitao, P.A.Watson (Postgraduate School of Electrical & Electronic Engng., Univ. of Bradford, Bradford, England).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.51-5 part 2
The classification of the types of weather associated with various rainfall structures is a routine aspect of meteorology, usually dependent on a high degree of observer skill. In addition, a knowledge of rain-storm type is a pre-requisite to the development of slant path attenuation prediction models based on storm physical structure. In this paper we describe the application of dual-polarisation radar data to the automatic detection of rainstorm type and to the determination of hydrometeor type. (4 refs.)

Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC) .... See Entry 69777

Chemistry of the Unpolluted and Polluted Troposphere. Proceedings of the NATO Advanced Study Institute .... See Entry 69791

Deposition of Atmospheric Pollutants. Proceedings of a Colloquium .... See Entry 69792

Atmospheric Turbulence and Air Pollution Modelling .... See Entry 69793

An examination of the composite-roughness scattering model . See Entry 71289

The solar radiation resource .... See Entry 73411

Preliminary research in the measurement of the solar radiation by transient technique .... See Entry 73413

Climatic predispositions of Yugoslavia for solar energy application .... See Entry 73414

Digital data gathering for solar energy measurement .... See Entry 73415

Diffuse and global solar spectral irradiance under cloudless skies .... See Entry 73416

Terrestrial solar spectral data sets .... See Entry 73422

Acid rain deposition patterns in the continental United States .... See Entry 73496

Heavy metal and sulphur concentrations in Sphagnum magellanicum Brid. in the Maritime Provinces, Canada .... See Entry 73497

The problem of aliasing in inferring long-range air pollution transport to Mauna Loa, Hawaii .... See Entry 73498

A contribution to the theory of anthropogenic effects on local meteorological processes in a city .... See Entry 73503

Inadvertant effect of large cities and industrial centers on precipitation .... See Entry 73504

Wind-stress coefficients over sea surface from breeze to hurricane .... See Entry 73828

Influence of a water temperature anomaly in the north Atlantic on the circulation, thermal regime, and moisture cycle in the northern hemisphere atmosphere .... See Entry 73833

Accuracy of calculation of the parameters of wind waves at sea as a function of the basic wave-forming factors .... See Entry 73836

Exchange of H_2S between air and water .... See Entry 73840

Anomalies in temperature and rainfall during warm Arctic seasons .... See Entry 73905

On climatic changes due to a deliberate flooding of the Qattara depression (Egypt) .... See Entry 73906

The migration of geese as an indicator of climate change in the southern Hudson Bay region between 1715 and 1851 .... See Entry 73907

Some results of climatic generalisation of meteorological observations in the Antarctic .... See Entry 73908

El Chichon and Britain's weather .... See Entry 73910

Global distribution of stratospheric aerosols by satellite measurements .... See Entry 73911

Atmospheric transmission at Davos, Switzerland 1909-1979 .... See Entry 73912

The effect of surface striations on the absorption of shortwave radiation .... See Entry 73913

Isotopic composition of the ocean-atmospheric system in the geologic past .... See Entry 73916

An experiment of infrared spectroscopy for the first Spacelab mission .... See Entry 73927

On the calibration and temperature behaviour of single-beam infrared hygrometers .... See Entry 73932

Improved procedure for Raman lidar measurements of the atmospheric temperature .... See Entry 73933

July 1981 NASA workshop on passive remote sensing of the troposphere .... See Entry 73945

Complementary code properties for MST radar observations .. See Entry 73946

Evaluation of the spectral resolution of optical equipment for measuring minor gas components of the atmosphere .... See Entry 73951

Possibility of determining the temperature profile of the atmosphere by the acoustic sounding method .... See Entry 73952

92.60S Climatology

73905 **Anomalies in temperature and rainfall during warm Arctic seasons.** J.Jager, W.W.Kellogg.
Clim. Change (Netherlands), vol.5, no.1, p.39-60 (1983).
The regional patterns of change of temperature and rainfall that might accompany a global warming due to increased carbon dioxide can be studied by experiments with theoretical models of the climate system, by reconstructing the climates of past warm epochs, and by determining the anomalies of temperature and precipitation that prevailed during years or seasons when the Arctic region was unusually warm. The authors pursue the last course, making use of the northern hemisphere meteorological data record for the period 1931-1978. Hemispheric maps of anomalies of both temperature and precipitation are presented for the 10 warmest Arctic seasons and years, and for differences between the 5 warmest and 5 coldest consecutive Arctic winters. (17 refs.)

73906 **On climatic changes due to a deliberate flooding of the Qattara depression (Egypt).** M.Segal, R.A.Pielke (Dept. of Atmospheric Sci., Colorado State Univ., Fort Collins, CO, USA), Y.Mahrer.
Clim. Change (Netherlands), vol.5, no.1, p.73-83 (1983).
A numerical mesoscale model is applied to a preliminary evaluation of the mesoscale climatic changes due to a deliberate flooding of the Qattara depression in Egypt. The simulation of a typical summer synoptic situation indicates noticeable effects on the horizontal and vertical wind fields, and on the temperature and moisture patterns. (18 refs.)

73907 **The migration of geese as an indicator of climate change in the southern Hudson Bay region between 1715 and 1851.** T.Ball (Univ. of Winnipeg, Winnipeg, Manitoba, Canada).
Clim. Change (Netherlands), vol.5, no.1, p.85-93 (1983).
Observations and records maintained by the Hudson's Bay Company at York Factory and Churchill Factory on Hudson Bay between 1714 and 1825, serve as the source of information for a study of changes in the date of arrival of geese as a phenological indicator of climatic change. Changes in the migration pattern of geese are reflected in the changing date of arrival at the same location over a long period of time. Variations in this date are determined to be a function of southerly or tailwinds in the northward spring migration. (15 refs.)

73908 **Some results of climatic generalisation of meteorological observations in the Antarctic.** E.P.Borisenkov, L.V.Dolganov (A.I. Voeikov Main Geophys. Obs., Leningrad, USSR).
J. Geophys. Res. (USA), vol.87, no.C12, p.9653-66 (20 Nov. 1982). [received: May 1983]
Some new climatic characteristics of the Antarctic are presented. Maps of atmospheric pressure, temperature, humidity, and wind regime, as well as probabilistic curves detailing the Antarctic climate, particularly in terms of extreme values, are given. (23 refs.)

73909 **Sensitivity of an annual mean diffusive energy balance model with an ice sheet.** K.P.Bowman (Geophys. Fluid Dynamics Program, Princeton Univ., Princeton, NJ, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9667-74 (20 Nov. 1982). [received: May 1983]
The sensitivity of a diffusive energy balance model that contains a simple ice sheet is compared with that of a model with snow cover only. The effect of the elevated ice sheet surface on the radiative cooling is calculated by using a radiative transfer model. Because the temperature in the atmosphere decreases with height, the main effect of the ice sheet elevation is to reduce the outgoing infrared radiation. This reduction in the radiative cooling decreases the sensitivity of the ice sheet size to changes in the solar constant by partially counteracting the albedo feedback. For a reasonable choice of parameters, this effect can reduce the strength of the albedo feedback by a factor of 2. (23 refs.)

73910 **El Chichon and Britain's weather.** J.Gribbin.
New Sci. (GB), vol.98, no.1353, p.5-15 (14 April 1983).
The eruption last April of El Chichon on the Yucatan Peninsula of Mexico, was one of the three biggest volcanic explosions this century. It put 16 million tonnes of material into the upper atmosphere. Early in 1983, a consensus seemed to be emerging among theorists using computer models of the atmosphere that this material, now spreading across the northern hemisphere, would lead to a cooling of perhaps half a degree centigrade, with the peak effect occurring in the late summer of 1983 or the winter of 1983-4. But a detailed study of the climatic effects of major historial eruptions has now led Mick Kelly and Chris Sear, of the Climatic Research Unit in Norwich, to conclude that the peak influence of El Chichon on climate has already passed. (no refs.)

Sea Level Ice and Climatic Change. Proceedings of a Symposium .... See Entry 69794

Recent changes in sea level and their possible causes .... See Entry 73805

Periodicity of variations in the annual precipitation totals in Poland .... See Entry 73853

Variability of atmospheric temperature and circulation regimes of the Northern Hemisphere .... See Entry 73895

Atmospheric transmission at Davos, Switzerland 1909-1979 .... See Entry 73912

92.65 ATMOSPHERIC OPTICS

(see also 42.00 Optics)

73911 **Global distribution of stratospheric aerosols by satellite measurements.** M.P.McCormick (NASA, Langley Res. Center, Hampton, VA, USA).
AIAA J. (USA), vol.21, no.4, p.633-5 (April 1983).
Describes the first-ever global aerosol climatology that is being developed by two Earth-orbiting satellite sensors: stratospheric aerosol measurement II (SAM II) and stratospheric aerosol and gas experiment (SAGE). The data will show the normal background aerosol, its seasonal and hemispheric variations, the existence of polar stratospheric clouds (probably made up of ice particles), and the impact of volcanic eruptions (particularly the 1980 eruption of Mount St. Helens). (9 refs.)

73912 **Atmospheric transmission at Davos, Switzerland 1909-1979.** D.V.Hoyt, C.Frohlich (Phys.-Meteorologisches Obs., World Radiation Center, Davos, Switzerland).
Clim. Change (Netherlands), vol.5, no.1, p.61-71 (1983).
Pyrheliometric measurements at Davos, Switzerland, from 1909 to 1979 are used to reconstruct the time history of atmospheric transmission. Measurements were numerous enough to allow yearly and seasonal values of atmospheric transmission to be determined. Other than the eruptions of Katmai in 1912 and Agung in 1963, there are no significant long-term changes in atmospheric transmission observed at this central European site. The implications of this result upon those theories of climatic change which depend upon changes in atmospheric transmission are briefly considered. (22 refs.)

73913 **The effect of surface striations on the absorption of shortwave radiation.** J.J.Carroll (Dept. of Land, Air & Water Resources, Univ. of California, Davis, CA, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9647-52 (20 Nov. 1982). [received: May 1983]
Most natural surfaces have shortwave albedos that are directly dependent on solar zenith angle. Strong dependences are well known for liquid water and have recently been reiterated for snow surfaces [Carroll and Fitch, 1981]. Many surfaces (e.g. water and dry snow) develop systematic macroscale ripple structures due to wind action (i.e. waves and sastrugi). This paper reports calculations of the effects of such structures on the solar radiation absorbed as a function of latitude, season, ripple amplitude, and ripple orientation. The ripples are represented as having triangular cross sections with the two upper faces tilted at angle B from the horizontal. (10 refs.)

73914 **Rapid transmittance integration using line blending and a straight-line fit to line shapes.** V.Oinas (M/A-Com Sigma Data Services Corp., New York, NY, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.407-11 (May 1983).
A rapid integration procedure has been developed for calculating transmittances of atmospheric gases. The basis for the method is the direct calculation of equivalent widths by a parametric formulation and the representation of the line shapes by a series of straight-line segments. In addition, nearby lines are blended to give a reduced number of suitably averaged lines. The method achieves run times approximately an order of magnitude faster than conventional line-by-line integration, with accuracies of a few digits in the third decimal place for wavenumber intervals of $10\ cm^{-1}$. (4 refs.)

73915 **A radiative transfer model for surface radiation budget studies.** S.K.Gupta (NASA Langley Res. Center, Hampton, VA, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.419-27 (May 1983).
A high resolution spectral radiative transfer model of the troposphere for computing downwelling radiance and flux density at the surface in the 5-200 μm region has been developed. The model is fast and accurate and takes into consideration all major and minor constituents active in this region, namely, water vapor, carbon dioxide, ozone, nitrous oxide, and methane. It uses the quasi-random band model of absorption for computing atmospheric transmittances due to various bands. Continuum absorption by water vapor in the 8-14 μm region has also been taken into account. The model has been used to examine the sensitivity of downwelling flux to variations of surface water vapor pressure (or surface relative humidity), water vapor scale-height and concentrations of other gaseous constituents of the atmosphere. In addition, sensitivity to changes in a number of cloud parameters, namely, fractional cloud cover, cloud height, and high-cloud emissivity, has also been examined. Results obtained with the present model compare well with those from other empirical and semi-empirical correlations. The present work demonstrates, for the first time, the feasibility of using a high-resolution narrow-band model for computing this flux for a meteorological application. (23 refs.)

Albedo for an inhomogeneous half space .... See Entry 71072

Diffuse and global solar spectral irradiance under cloudless skies .... See Entry 73416

Terrestrial solar spectral data sets .... See Entry 73422

Scattering of radiation by particles in low-altitude plumes .... See Entry 73495

Data on total and spectral solar irradiance .... See Entry 73852

Effect of wind-generated waves on the transfer of solar radiation in the atmosphere-ocean system .... See Entry 73886

Circumsolar radiation calculated for various atmospheric conditions .... See Entry 73889

Optical transmission through aerosol deposits on diffusely reflective filters: a method for measuring the absorbing component of aerosol particles .... See Entry 73920

Application of the 2-D discrete-ordinates method to multiple scattering of laser radiation .... See Entry 73922

Video polarimetry: a new imaging technique in atmospheric science .... See Entry 73923

Random modulation CW lidar .... See Entry 73925

Improved procedure for Raman lidar measurements of the atmospheric temperature .... See Entry 73933

Evaluation of the spectral resolution of optical equipment for measuring minor gas components of the atmosphere .... See Entry 73951

Resonant extinction of lidar returns from the alkali metal layers in the upper atmosphere .... See Entry 73953

Images in astronomy .... See Entry 73992

92.90 OTHER TOPICS IN HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

73916 Isotopic composition of the ocean-atmospheric system in the geologic past. J.Hoefs (Geochem. Inst., Gottingen, Germany).
In book: *Evolution of the Earth*, R.J.O'Connell, W.S.Fyfe [Ed.], p.110-19. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Besides the oxygen stable isotopic composition of ocean water this review concentrates on the sulfur isotopic composition of ocean sulfate, the carbon isotope composition in the system ocean-atmosphere-biosphere and the strontium isotopic composition of ocean water. It is shown that there are definite fluctuations in the isotopic composition of these elements during the Earth's history, especially during the Paleozoic. These changes can only be explained if very important geologic parameters have fluctuated, two of which are the distribution of land and sea, and the atmospheric oxygen concentration (maybe due to varying rates of photosynthesis or carbon burial and sulfide oxidation). (63 refs.)

Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC) .... See Entry 69777

93.00 GEOPHYSICAL OBSERVATIONS, INSTRUMENTATION, AND TECHNIQUES

93.30 INFORMATION RELATED TO GEOGRAPHICAL REGIONS

Tectonic and geologic evolution of southeast asian seas and islands. Pt.2 .... See Entry 69796

Change in the ice and thermal regime of the Vilyui river in the lower pool of the Vilyui I-II hydrostation .... See Entry 73403

Macrobenthos of Lake Naini Tal (UP, India) with particular reference to pollution .... See Entry 73491

Acid rain deposition patterns in the continental United States .... See Entry 73496

Heavy metal and sulphur concentrations in Sphagnum magellanicum Brid. in the Maritime Provinces, Canada .... See Entry 73497

The problem of aliasing in inferring long-range air pollution transport to Mauna Loa, Hawaii .... See Entry 73498

Gravimetric terrain corrections in western Canada .... See Entry 73705

Paleomagnetism of the Deadman's Bay diabase dikes from northeastern central Newfoundland .... See Entry 73709

Paleomagnetism of diabase dikes from the Bonavista bay area of northeastern central Newfoundland .... See Entry 73710

Paleomagnetism of the Lac St.-Jean anorthosite and related rocks, Grenville Province, Quebec .... See Entry 73711

Paleomagnetism of the Borden dykes of Baffin Island and its bearing on the Grenville Loop .... See Entry 73712

Magnetic inclination of basaltic rocks from the East-Pacific Rise at 21 degrees North and validity of polarity criteria .... See Entry 73713

Paleomagnetism of Archean volcanics and Proterozoic dikes in La Grande Riviere area of Nouveau-Quebec .... See Entry 73714

Paleomagnetism of Late Archean metavolcanics and metasediments, Abitibi orogen, Canada: tholeiites of the Kinojevis Group .... See Entry 73715

A magnetic profile and inferred seafloor spreading in Foul Bay, Red Sea .... See Entry 73716

Electrical conductivity of the Earth's crust and the upper mantle in Kamchatka, based on data from magnetotelluric logging .... See Entry 73718

A Miocene polarity transition (R-N) from the Agno Batholith, Luzon .... See Entry 73719

Magnetometer arrays and geodynamics .... See Entry 73722

Seismicity induced by surface mining: the Belchatow, Poland, earthquake of 29 November 1980 .... See Entry 73723

Periodicity of strong mining tremors in the Lubic copper mine .... See Entry 73724

Comparison of earthquake prediction approaches in the Tokai area of Japan and in California .... See Entry 73740

Mapping the Miocene Farallon Ridge jump on the Pacific plate: a seismic line of weakness .... See Entry 73742

Chronology and development of the 1980 earthquake at El Asnam (Algeria): a postscript .... See Entry 73743

Some aspects of tectonic history of the Holy Cross Mountains in the light of palaeomagnetic studies .... See Entry 73751

Tectonic significance of Cameron's Line in the vicinity of the Hodges Complex—an imbricate thrust model for western Connecticut .... See Entry 73752

The southern Caspian: a compressional depression floored by a trapped, modified oceanic crust .... See Entry 73753

U-Pb geochronology of the Bokan Mountain peralkaline granite, southeastern Alaska .... See Entry 73754

Chronology of tectonothermal activity in the western Avalon Zone of the Newfoundland Appalachians .... See Entry 73755

Trace-element mobility during low-grade metamorphism and silicification of basaltic rocks from Saint John, New Brunswick .... See Entry 73756

A geothermal model of the lithosphere and a map of the thickness of the lithosphere on the territory of the USSR .... See Entry 73759

Permafrost, heat flow, and the geothermal regime at Prudhoe Bay, Alaska .... See Entry 73762

Structure and origin of the J Anomaly Ridge, western North Atlantic Ocean .... See Entry 73763

Pb-Sr isotope variation in Indian Ocean basalts and mixing phenomena .... See Entry 73764

The Jurassic Basin in the Maritime Alps (France): palaeogeography, tectonic control and later deformations .... See Entry 73773

Paleomagnetic constraints on the Late Cretaceous and Cenozoic tectonics of southeastern Asia .... See Entry 73774

Analysis of states of stress between provinces of constant stress .... See Entry 73775

Recomputation of vertical crustal motions near Palmdale, California, 1959-1975 .... See Entry 73776

Tectonic influences on sedimentation, Early Cretaceous, East Flank Powder River Basin, Wyoming and South Dakota .... See Entry 73777

Intraplate stress orientations from Alberta oil-wells .... See Entry 73779

Hudson Bay river sediments and regional glaciation. II. Comparison of carbonate mineralogy of size fractions for ice movement inference ..See Entry 73782

A multitracer approach to the study of erosion in the northeast equatorial Pacific .... See Entry 73783

Hydrothermal manganese oxide deposits from Galapagos mounds, DSDP Leg 70, hole 509B and 'Alvin' dives 729 and 721 .... See Entry 73784

Marine geology of the Hess Rise. II. Basement morphology, sediment thickness, and structural geology .... See Entry 73785

Acoustic backscattering from the basin and margins of the Arctic Ocean .... See Entry 73786

Discrete single-domain and pseudo-single-domain titanomagnetite particles in silicic glass of an ash-flow tuff .... See Entry 73788

Sedimentology of Upper Ordovician—Silurian sequences on New World Island, Newfoundland: separate fault-controlled basins? .... See Entry 73794

Morphometry of open rock basins, Kananaskis area, Canadian Rocky Mountains .... See Entry 73795

Depositional environments along a carbonate ramp to slope transition in the Silurian of Washington Land, North Greenland .... See Entry 73796

Discovery of striated calcareous concretions in the Gentilly Till of Saint Laurent, Quebec .... See Entry 73797

Cemented horizon in subarctic Alaskan sand dunes .... See Entry 73799

Evolution of liquid and solid discharges of a sub-boreal estuary: St. Jean river, Quebec (north coast of Gulf of St. Lawrence) .... See Entry 73803

On the effect of bathymetry in numerical storm surge simulation experiments .... See Entry 73804

Long-range Atlantic acoustic multipath identification .... See Entry 73810

Mesoscale variability of SOFAR group velocity in the Northwest Pacific .... See Entry 73812

Modeling ocean-bottom reflection loss measurements with the plane-wave reflection coefficient .... See Entry 73813

Recent long-term moored instrument observations in the western North Pacific .... See Entry 73814

Chlorofluoromethanes in the Northeast Pacific Ocean: measured vertical distributions and application as transient tracers of upper ocean mixing .... See Entry 73815

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Continental shelf waves of diurnal period along Vancouver Island .... See Entry 73818

The subtropical front: satellite observations during FRONTS 80 .... See Entry 73819

Oceanographic aspects of the Emperor Seamounts region .... See Entry 73820

An analysis of the optical features of the near bottom and bottom nepheloid layers in the area of the Scotian Rise .... See Entry 73821

Circulation in the Hudson Shelf Valley: MESA physical oceanographic studies in New York Bight. I .... See Entry 73822

The structure of circulation: MESA physical oceanographic studies in New York Bight. II .... See Entry 73823

Variability of the near-surface residual current in the lower St. Lawrence estuary .... See Entry 73824

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Radium 228 as a tracer of basin wide processes in the abyssal ocean .... See Entry 73827

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The nonlinear Fourier analysis of internal solitons in the Andaman Sea .... See Entry 73831

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Influence of a water temperature anomaly in the north Atlantic on the circulation, thermal regime, and moisture cycle in the northern hemisphere atmosphere .... See Entry 73833

Forecasting the water salinity of the bottom horizon of the Gulf of Riga .... See Entry 73837

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The identification of Eemian Interglacial and Weichselian Interstadial deposits in Finland .... See Entry 73841

Evidence of pre-late Wisconsinan glaciations on Labrador Shelf—Cartwright Saddle region .... See Entry 73842

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Late Quaternary glacial history of the hermitage area of southern Newfoundland .... See Entry 73845

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73917 Probabilistic cluster labeling of imagery data. C.B.Chittineni (Conoco Inc., Ponca City, OK, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.145-55 (April 1983).
The author considers the problem of obtaining the probabilities of class labels for the clusters using spectra and spatial information from a given set of labeled patterns and their neighbors. A relationship is developed between class and cluster conditional densities in terms of probabilities of class labels for the clusters. Expressions are presented for updating the a posteriori probabilities of the classes of a pixel using information from its local neighborhood. Fixed-point iteration schemes are developed for obtaining the optimal probabilities of class labels for the clusters. These schemes utilize spatial information and also the probabilities of label imperfections. Furthermore, experimental results from the processing of remotely sensed multispectral scanner imagery data are presented. (21 refs.)

73918 Edge and line detection in multidimensional noisy imagery data. C.B.Chittineni (Conoco Inc., Ponca City, OK, USA).
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73919 A two step linear statistical technique using leaps and bounds procedure for retrieval of geophysical parameters from microwave radiometric data. P.C.Pandey, R.K.Kakar (Earth & Space Sci. Div., Jet Propulsion Lab., Pasadena, CA, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.208-14 (April 1983).
A linear statistical technique using leaps and bounds procedure is developed for retrieving geophysical parameters from remote measurements. It is applied to the retrieval of sea surface temperature (SST) from the scanning multichannel microwave radiometer (SMMR) on the SEASAT satellite. The technique involves the application of an efficient algorithm to select the best fixed-size subset, of the 10 SMMR channels for linearly retrieving a given geophysical parameter. The 5 channel subset [6.6*V*, 6.6*H*, 10*H*, 18*V*, 21*H*], where *V* and *H* refer to the vertical and horizontal polarizations, respectively and numbers are the channel frequencies in gigahertz, provides the minimum RMS error in estimating SST. Comparison with ground truth indicates that the algorithm infers SST with an RMS accuracy of better than 1.5K under most environmental conditions. A quality control procedure is proposed which could further improve the accuracy. (17 refs.)

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Ocean bottom tilt observation system .... See Entry 73948

93.85 INSTRUMENTATION AND TECHNIQUES FOR GEOPHYSICAL RESEARCH

73920 Optical transmission through aerosol deposits on diffusely reflective filters: a method for measuring the absorbing component of aerosol particles. H.Rosen, T.Novakov (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Appl. Opt. (USA), vol.22, no.9, p.1265-7 (1 May 1983).
A laser transmission technique developed at Lawrence Berkeley Laboratory has been used extensively to determine the absorption coefficient and the graphic carbon content of aerosols. The laser transmission apparatus compares the transmission of a 632.8-nm He-Ne laser beam through a loaded filter relative to the transmission through a blank filter. After multiple scattering through the filter medium, the forward scattered light is collected by low *f* number optics and detected by a photomultiplier. The authors present a simple theoretical model which accounts for the observations and point out the critical role of the filter substrate as an almost perfect diffuse reflector in the technique. (12 refs.)

73921 Image intensifier gain measurements. L.S.Smith, E.P.King, L.L.Cogger (Phys. Dept., Univ. of Calgary, Calgary, Alberta, Canada).
Appl. Opt. (USA), vol.22, no.9, p.1268-70 (1 May 1983).
The application of microchannel plate (MCP) image intensifiers to measure low level monochromatic emissions such as those in aurora and airglow has created the need to evaluate these devices in appropriate terms. In particular, the current manufacturers' practices of measuring luminous gain using a tungsten light source makes it difficult to evaluate the performance of the device in measuring monochromatic radiation. The luminous gain measured in this way is typically an order of magnitude larger than the absolute power gain at visible wavelengths. The authors compare the various ways of measuring the gain of image intensifiers in order to assist potential users with applications other than visual enhancement. (2 refs.)

73922 Application of the 2-D discrete-ordinates method to multiple scattering of laser radiation. A.Zardecki, S.A.W.Gerstl, J.F.Embury (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Appl. Opt. (USA), vol.22, no.9, p.1346-53 (1 May 1983).
The discrete-ordinates finite-element radiation transport code TWOTRAN is applied to describe the multiple scattering of a laser beam from a reflecting target. For a model scenario involving a 99% relative humidity rural aerosol the authors compute the average intensity of the scattered radiation and correction factors to the Beer-Lambert law arising from multiple scattering. As the results indicate, 2-D *x-y* and *r-z* geometry modeling can reliably describe a realistic 3-D scenario. Specific results are presented for the two visual ranges of 1.52 and 0.76 km which show that, for sufficiently high aerosol concentrations (e.g. equivalent to $V=0.76$ km), the target signature in a distant detector becomes dominant by multiply scattered radiation from interactions of the laser light with the aerosol environment. The merits of the scaling group and the delta-*M* approximation for the transfer equation are also explored. (27 refs.)

73923 Video polarimetry: a new imaging technique in atmospheric science. T.Prosch, D.Hennings, E.Raschke (Inst. fur Geophysik und Meteorologie, Univ. zu Koln, Koln, Germany).
Appl. Opt. (USA), vol.22, no.9, p.1360-3 (1 May 1983).
An imaging polarimeter has been built to study the polarization of solar radiation ($\lambda=550$ nm) scattered and reflected from the natural environment. The instrument generates false color images as multiparameter display of the degree of polarization, azimuth of polarization, and the radiance. These video signals can be digitized into a computer-compatible format. As an example of application, the polarization properties of light reflected from a lake and its environment are discussed. (7 refs.)

73924 High spectral resolution lidar system with atomic blocking filters for measuring atmospheric parameters. H.Shimizu, S.A.Lee, C.Y.She (Phys. Dept., Colorado State Univ., Fort Collins, CO, USA).
Appl. Opt. (USA), vol.22, no.9, p.1373-81 (1 May 1983).
A new lidar technique for measuring the profiles of backscatter ratio, atmospheric visibility, and atmospheric temperature is proposed. Based on the theory of high resolution Rayleigh/Mie scattering, the feasibility and advan-

Circumsolar radiation calculated for various atmospheric conditions .... See Entry 73889

Optical transmission through aerosol deposits on diffusely reflective filters: a method for measuring the absorbing component of aerosol particles .... See Entry 73920

Application of the 2-D discrete-ordinates method to multiple scattering of laser radiation .... See Entry 73922

Video polarimetry: a new imaging technique in atmospheric science .... See Entry 73923

Random modulation CW lidar .... See Entry 73925

Improved procedure for Raman lidar measurements of the atmospheric temperature .... See Entry 73933

Evaluation of the spectral resolution of optical equipment for measuring minor gas components of the atmosphere .... See Entry 73951

Resonant extinction of lidar returns from the alkali metal layers in the upper atmosphere .... See Entry 73953

Images in astronomy .... See Entry 73992

92.90 OTHER TOPICS IN HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

73916 **Isotopic composition of the ocean-atmospheric system in the geologic past.** J.Hoefs (Geochem. Inst., Gottingen, Germany).
In book: *Evolution of the Earth,* R.J.O'Connell, W.S.Fyfe [Ed.], p.110-19. Washington, DC, USA: American Geophysical Union (1981), 282 pp. [0 87590 506 4]
Besides the oxygen stable isotopic composition of ocean water this review concentrates on the sulfur isotopic composition of ocean sulfate, the carbon isotope composition in the system ocean-atmosphere-biosphere and the strontium isotopic composition of ocean water. It is shown that there are definite fluctuations in the isotopic composition of these elements during the Earth's history, especially during the Paleozoic. These changes can only be explained if very important geologic parameters have fluctuated, two of which are the distribution of land and sea, and the atmospheric oxygen concentration (maybe due to varying rates of photosynthesis or carbon burial and sulfide oxidation). (63 refs.)

Symposium on the Role of the Oceans in Atmospheric Chemistry (ROAC) .... See Entry 69777

93.00 GEOPHYSICAL OBSERVATIONS, INSTRUMENTATION, AND TECHNIQUES

93.30 INFORMATION RELATED TO GEOGRAPHICAL REGIONS

Tectonic and geologic evolution of southeast asian seas and islands. Pt.2 .... See Entry 69796

Change in the ice and thermal regime of the Vilyui river in the lower pool of the Vilyui I-II hydrostation .... See Entry 73403

Macrobenthos of Lake Naini Tal (UP, India) with particular reference to pollution .... See Entry 73491

Acid rain deposition patterns in the continental United States .... See Entry 73496

Heavy metal and sulphur concentrations in Sphagnum magellanicum Brid. in the Maritime Provinces, Canada .... See Entry 73497

The problem of aliasing in inferring long-range air pollution transport to Mauna Loa, Hawaii .... See Entry 73498

Gravimetric terrain corrections in western Canada .... See Entry 73705

Paleomagnetism of the Deadman's Bay diabase dikes from northeastern central Newfoundland .... See Entry 73709

Paleomagnetism of diabase dikes from the Bonavista bay area of northeastern central Newfoundland .... See Entry 73710

Paleomagnetism of the Lac St.-Jean anorthosite and related rocks, Grenville Province, Quebec .... See Entry 73711

Paleomagnetism of the Borden dykes of Baffin Island and its bearing on the Grenville Loop .... See Entry 73712

Magnetic inclination of basaltic rocks from the East-Pacific Rise at 21 degrees North and validity of polarity criteria .... See Entry 73713

Paleomagnetism of Archean volcanics and Proterozoic dikes in La Grande Riviere area of Nouveau-Quebec .... See Entry 73714

Paleomagnetism of Late Archean metavolcanics and metasediments, Abitibi orogen, Canada: tholeiites of the Kinojevis Group .... See Entry 73715

A magnetic profile and inferred seafloor spreading in Foul Bay, Red Sea .... See Entry 73716

Electrical conductivity of the Earth's crust and the upper mantle in Kamchatka, based on data from magnetotelluric logging .... See Entry 73718

A Miocene polarity transition (R-N) from the Agno Batholith, Luzon .... See Entry 73719

Magnetometer arrays and geodynamics .... See Entry 73722

Seismicity induced by surface mining: the Belchatow, Poland, earthquake of 29 November 1980 .... See Entry 73723

Periodicity of strong mining tremors in the Lubic copper mine .... See Entry 73724

Comparison of earthquake prediction approaches in the Tokai area of Japan and in California .... See Entry 73740

Mapping the Miocene Farallon Ridge jump on the Pacific plate: a seismic line of weakness .... See Entry 73742

Chronology and development of the 1980 earthquake at El Asnam (Algeria): a postscript .... See Entry 73743

Some aspects of tectonic history of the Holy Cross Mountains in the light of palaeomagnetic studies .... See Entry 73751

Tectonic significance of Cameron's Line in the vicinity of the Hodges Complex—an imbricate thrust model for western Connecticut .... See Entry 73752

The southern Caspian: a compressional depression floored by a trapped, modified oceanic crust .... See Entry 73753

U-Pb geochronology of the Bokan Mountain peralkaline granite, southeastern Alaska .... See Entry 73754

Chronology of tectonothermal activity in the western Avalon Zone of the Newfoundland Appalachians .... See Entry 73755

Trace-element mobility during low-grade metamorphism and silicification of basaltic rocks from Saint John, New Brunswick .... See Entry 73756

A geothermal model of the lithosphere and a map of the thickness of the lithosphere on the territory of the USSR .... See Entry 73759

Permafrost, heat flow, and the geothermal regime at Prudhoe Bay, Alaska .... See Entry 73762

Structure and origin of the J Anomaly Ridge, western North Atlantic Ocean .... See Entry 73763

Pb-Sr isotope variation in Indian Ocean basalts and mixing phenomena .... See Entry 73764

The Jurassic Basin in the Maritime Alps (France): palaeogeography, tectonic control and later deformations .... See Entry 73773

Paleomagnetic constraints on the Late Cretaceous and Cenozoic tectonics of southeastern Asia .... See Entry 73774

Analysis of states of stress between provinces of constant stress .... See Entry 73775

Recomputation of vertical crustal motions near Palmdale, California, 1959-1975 .... See Entry 73776

Tectonic influences on sedimentation, Early Cretaceous, East Flank Powder River Basin, Wyoming and South Dakota .... See Entry 73777

Intraplate stress orientations from Alberta oil-wells .... See Entry 73779

Hudson Bay river sediments and regional glaciation. II. Comparison of carbonate mineralogy of size fractions for ice movement inference .... See Entry 73782

A multitracer approach to the study of erosion in the northeast equatorial Pacific .... See Entry 73783

Hydrothermal manganese oxide deposits from Galapagos mounds, DSDP Leg 70, hole 509B and 'Alvin' dives 729 and 721 .... See Entry 73784

Marine geology of the Hess Rise. II. Basement morphology, sediment thickness, and structural geology .... See Entry 73785

Acoustic backscattering from the basin and margins of the Arctic Ocean .... See Entry 73786

Discrete single-domain and pseudo-single-domain titanomagnetite particles in silicic glass of an ash-flow tuff .... See Entry 73788

Sedimentology of Upper Ordovician—Silurian sequences on New World Island, Newfoundland: separate fault-controlled basins? .... See Entry 73794

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Evolution of liquid and solid discharges of a sub-boreal estuary: St. Jean river, Quebec (north coast of Gulf of St. Lawrence) .... See Entry 73803

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73920 Optical transmission through aerosol deposits on diffusely reflective filters: a method for measuring the absorbing component of aerosol particles. H.Rosen, T.Novakov (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Appl. Opt. (USA), vol.22, no.9, p.1265-7 (1 May 1983).
A laser transmission technique developed at Lawrence Berkeley Laboratory has been used extensively to determine the absorption coefficient and the graphic carbon content of aerosols. The laser transmission apparatus compares the transmission of a 632.8-nm He-Ne laser beam through a loaded filter relative to the transmission through a blank filter. After multiple scattering through the filter medium, the forward scattered light is collected by low f number optics and detected by a photomultiplier. The authors present a simple theoretical model which accounts for the observations and point out the critical role of the filter substrate as an almost perfect diffuse reflector in the technique. (12 refs.)

73921 Image intensifier gain measurements. L.S.Smith, E.P.King, L.L.Cogger (Phys. Dept., Univ. of Calgary, Calgary, Alberta, Canada).
Appl. Opt. (USA), vol.22, no.9, p.1268-70 (1 May 1983).
The application of microchannel plate (MCP) image intensifiers to measure low level monochromatic emissions such as those in aurora and airglow has created the need to evaluate these devices in appropriate terms. In particular, the current manufacturers' practices of measuring luminous gain using a tungsten light source makes it difficult to evaluate the performance of the device in measuring monochromatic radiation. The luminous gain measured in this way is typically an order of magnitude larger than the absolute power gain at visible wavelengths. The authors compare the various ways of measuring the gain of image intensifiers in order to assist potential users with applications other than visual enhancement. (2 refs.)

73922 Application of the 2-D discrete-ordinates method to multiple scattering of laser radiation. A.Zardecki, S.A.W.Gerstl, J.F.Embury (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Appl. Opt. (USA), vol.22, no.9, p.1346-53 (1 May 1983).
The discrete-ordinates finite-element radiation transport code TWOTRAN is applied to describe the multiple scattering of a laser beam from a reflecting target. For a model scenario involving a 99% relative humidity rural aerosol the authors compute the average intensity of the scattered radiation and correction factors to the Beer-Lambert law arising from multiple scattering. As the results indicate, 2-D x-y and r-z geometry modeling can reliably describe a realistic 3-D scenario. Specific results are presented for the two visual ranges of 1.52 and 0.76 km which show that, for sufficiently high aerosol concentrations (e.g. equivalent to V=0.76 km), the target signature in a distant detector becomes dominant by multiply scattered radiation from interactions of the laser light with the aerosol environment. The merits of the scaling group and the delta-M approximation for the transfer equation are also explored. (27 refs.)

73923 Video polarimetry: a new imaging technique in atmospheric science. T.Prosch, D.Hennings, E.Raschke (Inst. fur Geophysik und Meteorologie, Univ. zu Koln, Koln, Germany).
Appl. Opt. (USA), vol.22, no.9, p.1360-3 (1 May 1983).
An imaging polarimeter has been built to study the polarization of solar radiation (λ=550 nm) scattered and reflected from the natural environment. The instrument generates false color images as multiparameter display of the degree of polarization, azimuth of polarization, and the radiance. These video signals can be digitized into a computer-compatible format. As an example of application, the polarization properties of light reflected from a lake and its environment are discussed. (7 refs.)

73924 High spectral resolution lidar system with atomic blocking filters for measuring atmospheric parameters. H.Shimizu, S.A.Lee, C.Y.She (Phys. Dept., Colorado State Univ., Fort Collins, CO, USA).
Appl. Opt. (USA), vol.22, no.9, p.1373-81 (1 May 1983).
A new lidar technique for measuring the profiles of backscatter ratio, atmospheric visibility, and atmospheric temperature is proposed. Based on the theory of high resolution Rayleigh/Mie scattering, the feasibility and advan-

tages of using atomic vapor cells as blocking filters for measuring atmospheric parameters are demonstrated with a numerical example worked out in detail. Ten percent accuracy in determining backscatter ratio and visibility can be achieved easily. With a SNR of 300, temperature of 1K accuracy can be measured directly along with the backscatter ratio to a better accuracy of ±1%. Using a large lidar system and assuming 50-km visibility, the proposed technique can be applied to measure backscatter ratio and temperature profiles simultaneously for a 10-km path with 30-m depth resolution in 3 min. With higher SNR the atmospheric pressure profile can also be determined. (21 refs.)

73925 Random modulation CW lidar. N.Takeuchi, N.Sugimoto (Nat. Inst. for Environmental Studies, Tsukuba, Ibaraki, Japan), H.Baba, K.Sakurai.
Appl. Opt. (USA), vol.22, no.9, p.1382-6 (1 May 1983).
A new lidar scheme using a pseudorandom code modulated CW laser as a transmitting laser source (RM-CW lidar) is proposed and a demonstration of its use for aerosol measurement is shown. A formula for estimating the SNR values in RM-CW lidar was derived, and it was demonstrated that the observed SNR value was in good agreement with the calculation. (12 refs.)

73926 Seismological station of the Institute of Geophysics, Polish Academy of Sciences, in the Hornsund Fiord, Spitsbergen. M.Gorski, J.Niewiadomski (Inst. of Geophys., Polish Acad. of Sci., Warsaw, Poland).
Acta Geophys. Pol. (Poland), vol.30, no.3, p.279-85 (1982).
The seismological station operating from September 1978 in the Hornsund fiord, Spitsbergen, is briefly described. The station records natural earthquakes and glacier movements. Since seismometers are situated at four sites, the location of epicenters is possible. Instrument parameters, location of seismometer sites, and sample records are given. (5 refs.)

73927 An experiment of infrared spectroscopy for the first Spacelab mission. J.Laurent, M.-P.Lemaitre (ONERA, Chatillon, France), C.Lippens, C.Muller.
Aeronaut. & Astronaut. (France), no.98, p.60-70 (1983). In French.
An experiment, using an infrared spectrometer, has been selected by the European Space Agency as part of the First Spacelab Payload. The first flight of the Spacelab within the Space Shuttle will occur in 1983. The purpose of the experiment is to measure the atmospheric content of species between 20 and 140 km in altitude. The instrument performs limb-sounding measurements, either in emission mode or in absorption mode using the Sun as a source. This paper contains a short description of the experiment and a complete review of the scientific program scheduled for the first flight onboard Spacelab. This work is the result of a cooperation, started in 1976, between ONERA and IASB. (4 refs.)

73928 The resolution of seismic instruments used in treaty verification research. E.Herrin (Dept. of Geological Sci., Southern Methodist Univ., Dallas, TX, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S61-7 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
The resolution of the seismic sensors discussed in this paper is limited either by the self-noise of the system or the ambient ground noise at the observing site. The resolution limits of a particular system are frequency dependent. A major objective of the designer is to insure that seismic sensors are available which will be limited in resolution only by the ambient background noise at the quietest sites over the frequency band of interest in treaty verification research. This paper presents a review of the data currently available on the limiting resolution of the most advanced instruments used in this research program. (2 refs.)

73929 Automatic phase pickers: their present use and future prospects. R.Allen (Office of Earthquake Studies, US Geological Survey, Menlo Park, CA, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S225-42 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Automatic phase-picking algorithms are designed to detect a seismic signal on a single trace and to time the arrival of the signal precisely. Because of the requirement for precise timing, a phase-picking algorithm is inherently less sensitive than one designed only to detect the presence of a signal, but still can approach the performance of a skilled analyst. A typical algorithm filters the input data and then generates a function characterizing the seismic time series. This function may be as simple as the absolute value of the series, or it may be quite complex. Event detection is accomplished by comparing the function or its short-term average (STA) with a threshold value (THR), which is commonly some multiple of a long-term average (LTA) of a characteristic function. If the STA exceeds THR, a trigger is declared. If the event passes simple criteria, it is reported. Sensitivity, expected timing error, false-trigger rate, and false-report rate are interrelated measures of performance controlled by choice of the characteristic function and several operating parameters. (17 refs.)

73930 Global digital networks—current status and future directions. E.R.Engdahl, J.Peterson, N.A.Orsini (Denver Federal Center, US Geological Survey, Denver, CO, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S243-59 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
The Global Digital Seismograph Network (GDSN), which consists of the Seismic Research Observatories, the Abbreviated Seismic Research Observatories, and the Digital World-Wide Standardized Seismograph Network stations, and the International Deployment Accelerometers (IDA) network, which is operated by the University of California, produce digital seismic data in overlapping bands from short to tidal periods. GDSN and IDA data are available through national and regional data centers, the GDSN data on network-day tapes and the IDA data on bimonthly network tapes. The usefulness of the data is being enhanced by special processing techniques that overcome some of the constraints of band-limited bandwidth, addition of horizontal short-period recording, and the recording of very long-period signals at SRO stations. Several additional stations with bore-hole seismometers are planned, possibly with satellite data telemetry to the United States. However, in the future, the most likely source of new GDSN data is through the acquisition of digital data from independently operated national and regional networks that are being installed or contemplated in several countries. (36 refs.)

73931 Digital processing of regional network data. R.B.Herrmann (St. Louis Univ., St. Louis, MO, USA).
Bull. Seismol. Soc. Am. (USA), vol.72, no.6, pt.B, p.S261-76 (Dec. 1982). (Annual Meeting of the Seismological Society of America, Anaheim, CA, USA, 19-21 April 1982).
Much more than hypocenter location can be done with digital time histories obtained from regional seismic networks. Examples are given of how these data can be routinely processed to provide readily accessible intermediate results for subsequent studies, among which are velocity inversion using teleseismic P residuals, composite focal mechanism studies, and spectral analysis. The processing must be designed to be as routine and as complete as possible. Only with these two objectives achieved can the seismic networks be as productive as they should be. (22 refs.)

73932 On the calibration and temperature behaviour of single-beam infrared hygrometers. C.J.Moore (Inst. of Hydrology, Wallingford, England).
Boundary-Layer Meteorol. (Netherlands), vol.25, no.3, p.245-69 (March 1983).
The single-beam infrared hygrometer is increasingly popular as a device capable of measuring atmospheric humidity fluctuation for use in eddy correlation studies. However, it is generally applied without recognition of the effect of temperature on its performance. Calibration data from a number of such instruments indicate that the resulting calibration coefficients vary with mean temperature as a direct consequence of temperature dependence in photodetector response. Fluctuation in atmospheric and instrumental temperatures can also introduce significant errors in the measurement of humidity fluctuations. This paper draws attention to the problem of temperature dependence in the calibration of these devices and provides a framework for investigating the magnitude of other errors involved in their use. (15 refs.)

73933 Improved procedure for Raman lidar measurements of the atmospheric temperature. V.M.Mitev, S.L.Nitsolov (Inst. of Electronics, Bulgarian Acad. of Sci., Sofia, Bulgaria).
Bulg. J. Phys. (Bulgaria), vol.10, no.1, p.86-97 (1983).
An improved procedure for lidar measurements of the atmospheric temperature by the rotational Raman scattering in the air has been considered. Several spectral regions of the lidar response are detected simultaneously. The potential accuracy of measurement of the atmospheric temperature has been analysed theoretically. The relation between the multichannel detection accuracy and the lidar parameters has been obtained. Optimum statistical estimates for the temperatures have been derived. Algorithms and programmes for computer treatment of the experimental data have been developed. A model experiment on measuring the temperature under atmospheric conditions has been carried out. Good agreement between the theoretical and the attained accuracy in lidar measurements of the atmospheric temperature has been achieved. (16 refs.)

73934 Fission track dating of kimberlitic zircons. S.E.Haggerty (Dept. of Geology, Univ. of Massachusetts, Amherst, MA, USA), E.Raber, C.W.Naeser.
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.41-50 (April 1983).
Describes fission track dating of large single-crystal zircons, 1.0-1.5 cm in dimension. The use of large crystals overcomes the limitations imposed in conventional fission track analysis which utilizes crushed fragments. Low track densities, optical track dispersion, and the random orientation of polished surfaces in the etch and irradiation cycle are effectively overcome. Fission track ages of zircons from five African kimberlites are reported. (32 refs.)

73935 A dating method with ^{39}Ar. H.H.Loosli (Phys. Inst., Univ. Bern, Bern, Switzerland).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.51-62 (April 1983).
The principles of a dating method based on the cosmic-ray-produced radioisotope ^{39}Ar are given. Technical requirements such as background and standard gas samples and gas proportional counting systems are described. With samples extracted from Greenland ice it can be demonstrated that ^{39}Ar ages agree with ages obtained by other methods. First results on ocean water samples show that with this isotope valuable information on ocean mixing and circulation can be expected. ^{39}Ar results on groundwater samples disagree for some aquifers with conventional ^{14}C ages; possible explanations are discussed, especially underground production of ^{39}Ar. (21 refs.)

73936 Determination of the coefficients of absorption and scattering by a combined analysis of regular waves and coda. Yu.F.Kopnichev (O.Yu. Schmidt Inst. of Phys. of Earth, Acad. of Sci., USSR).
Izv. Acad. Sci. USSR. Phys. Solid Earth (USA), vol.18, no.1 (1982). Translation of: *Izv. Akad. Nauk SSSR Fiz. Zemli*, vol.18, no.1, p.34-44 (1982).
Methods of determining separately the coefficients of absorption and scattering in the lithosphere and lower mantle, are developed. The methods are based on the interpretation of regular waves and coda of the local earthquakes and on the use of multiple-scattering models. The limits of applicability of the models of single-and diffuse-scattering, are assessed. The coefficients of absorption and scattering are calculated in the lithosphere and lower mantle of the seismically active zones of Central Asia in the frequency interval of 0.6-27 Hz. (40 refs.)

73937 Drill stem resistance effects in electric telemetry links. J.Bhagwan, F.N.Trofimenkoff (Dept. of Electrical Engng., Univ. of Calgary, Calgary, Alberta, Canada).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.141-4 (April 1983).
An electric drill stem telemetry link with nonzero resistance is analyzed using a transmission line model. Attenuation and bandwidth are found to differ significantly from these corresponding to a perfectly conducting drill stem. The skin effect is found to reduce the channel bandwidth significantly. (5 refs.)

73938 The covariance least-squares algorithm for spectral estimation of processes of short data length. C.L.Nikias (Dept. of Electrical Engng. & Computer Sci., Univ. of Connecticut, Storrs, CT, USA), P.D.Scott.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.180-90 (April 1983).
A new method for generating the autoregressive (AR) process parameters for spectral estimation is introduced. The method fits AR models to the data optimally in the sense of minimizing the sum of squares of the error covariance function within the model prediction region, and is thus designated as the Covariance Least-Squares (CLS) algorithm. This minimization is shown to be identical with minimizing the weighted average one-step, linear prediction errors with adaptive weights corresponding to the energy of the data within the prediction region. The CLS algorithm is compared to the least-squares (LS) algorithm by simulation and asymptotic properties. It is shown that the CLS method combines all the desirable properties of the comparison algorithm with improved robustness in the presence of nonstationarity, namely additive transients and envelope modulation. It is also shown that the CLS algorithm provides asymptotically unbiased AR parameters, a property also shared by the comparison LS algorithm. (36 refs.)

73939 A multiple beam synthetic aperture radar design concept for geoscience applications. B.R.Jean (Dept. of Electrical Engng., Texas A&M Univ., College Station, TX, USA), J.W.Rouse,Jr..
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.2, p.201-7 (April 1983).
The multiple beam synthetic aperture radar (SAR) has been presented as a superior alternative to conventional side-looking SAR designs for mapping

Earth resources from space. The multiple beam approach provides wide swath coverage at nearly constant incident angle while conserving peak power. These desirable system characteristics, however, are realized at the expense of additional signal processing. A design example illustrates the attributes of the multiple beam SAR in comparison to a conventional side-looking system. A novel beam formation processing architecture is shown which can provide simultaneous range compression while forming the beams. A configuration for the image formation processor is proposed and analyzed in terms of an analog implementation which can perform Doppler compression at speeds faster than real time. These implementation schemes indicate that on-board processing for the multiple beam SAR is possible. (14 refs.)

73940 An assessment of ^{40}Ar-^{39}Ar dating of incompletely degassed xenoliths. A.R.Gillespie, J.C.Huneke, G.J.Wasserburg (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9247-57 (10 Nov. 1982). [received: May 1983]
The possibility of measuring the age of eruption of Pleistocene lavas by ^{40}Ar-^{39}Ar analysis of entrapped ancient potassic xenoliths is demonstrated by a study of model systems. Upon inclusion in the hot magma such xenoliths are commonly only partially degassed of radiogenic ^{40}Ar which has accumulated in them since their original crystallization. The residual ^{40}Ar will increase the apparent K/Ar age of the xenolith. However, if a xenolith is of Cretaceous age or younger, then a plateau in its ^{40}Ar-^{39}Ar age spectrum giving the age of eruption is expected to extend over 25-50% of the total ^{39}Ar released if degassing of the xenolith in the magma exceeded 90% and if the phases in the xenolith are characterized by sufficiently different diffusion dimensions or activation energies. If diffusion was from a bimodal population of spheres, then the radii must differ by a factor of 10 or more (or the diffusion coefficients by a factor of 100 or more); or if the spheres were equal in size (and in diffusion coefficients), then the activation energies must differ by a factor of at least 1.5. That such requirements may be realized in real xenoliths containing K-feldspars is expected from published activation energies for microcline and from data determined on a granitic xenolith which was degassed in an early Pleistocene basalt flow. The experimental results appear to establish that old xenoliths may contain Ar in distinctive phases which degas at sufficiently different temperatures as to permit determination of the age of degassing or eruption. (17 refs.)

73941 The determination of the internal magnetic field in magnetic grains. G.Smith, R.T.Merrill (Dept. of Geology, Univ. of Washington, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.87, no.B11, p.9419-23 (10 Nov. 1982). [received: May 1983]
For a number of years it has been supposed that for multidomain materials, the demagnetization factor *N* can be determined from either hysteresis loop or initial susceptibility measurements. Unfortunately, these methods involve a subtle circular argument which invalidates the entire analysis, ruling out the use of either of the aforementioned measurements in the determination of *N*. On examining possible alternatives to these methods the authors find the only viable one to be ferromagnetic resonance spectroscopy. Data are presented from a single crystal of magnetite which demonstrate that a reasonable value for *N* can be derived although only for the saturated state. (15 refs.)

73942 Sea surface temperature estimation using the NOAA 6 satellite Advanced Very High Resolution Radiometer. R.L.Bernstein (Scripps Inst. of Oceanography, La Jolla, CA, USA).
J. Geophys. Res. (USA), vol.87, no.C12, p.9455-65 (20 Nov. 1982). [received: May 1983]
A procedure for estimating sea surface temperature was developed by using the near and thermal infrared data available from full resolution (1.1 km field of view) daytime passes of the NOAA 6 satellite Advanced Very High Resolution Radiometer. It is demonstrated that spatially unresolved clouds and variable amounts of water vapour in the atmosphere are the major error sources. The procedure therefore incorporates a means of identifying radiometer fields of view which are virtually cloud-free, by comparing a measured solar radiation at 1μm, backscattered from the atmosphere, against that expected from a simple scattering model. (24 refs.)

73943 On the use of laser profilometry for ocean wave studies. C.R.McClain (Goddard Lab. for Atmospheric Sci., NASA/Goddard Space Flight Centre, Greenbelt, MD, USA), D.T.Chen, W.D.Hart.
J. Geophys. Res. (USA), vol.87, no.C12, p.9509-15 (20 Nov. 1982). [received: May 1983]
Airborne laser profilometer measurements of wave skewness and spectra are presented. The measurements were made during high wind and sea state conditions in the North Atlantic. The sea states ranged from 4.5 to 8.7 m and varied from swell to wind wave dominated situations. Skewness values for the five cases ranged from 0.08 to 0.28 and compare favourably with other existing measurements. Also, the Philips and Wallops spectral models show excellent agreement with profilometer spectra of developing seas. For one case where the seas were fully developed, the Pierson-Moskowitz spectrum provides the best representation. (20 refs.)

73944 A note on cross spectrum and coherence calculations. K.D.Saunders (Phys. Oceanography Branch, NSTL Station, Bay St. Louis, MS, USA), F.C.Hamrick.
J. Geophys. Res. (USA), vol.87, no.C12, p.9699-703 (20 Nov. 1982). [received: May 1983]
The physical oceanographic literature contains many instances of cross spectral and coherence calculations in which statistical stability is achieved through band averaging of the cross spectrum in frequency space, 'Constant Q' averaging is often used, sometimes with unexpected results. The present author shows how 'constant Q' frequency smoothing of the cross spectrum can lead to erroneous estimates of coherence. It is proposed that the well known technique of segment averaging using a number of raw spectral estimates computed from a sequence of time-domain windowed data be used for routine coherence (or cross-spectrum) calculations. The effects of window shape on coherence estimation are also considered. (10 refs.)

73945 July 1981 NASA workshop on passive remote sensing of the troposphere. L.S.Keafer,Jr., H.G.Reichle,Jr. (NASA Langley Res Center, Hampton, VA, USA).
J. Spacecr. & Rockets (USA), vol.20, no.2, p.172-7 (March-April 1983).
Potential roles of passive remote sensors in the study of the chemistry and related dynamics of the lower atmosphere were defined by a tropospheric passive remote sensing workshop, and technology advances required to implement these roles were identified. A promising role is in making global-scale, multilayer measurements of the more abundant trace tropospheric gaseous species (e.g., O_3, CO, CH_4, HNO_3) and of aerosol thickness and size distribution. It includes both nadir- and limb-viewing measurements. Technology advances focus on both scanning- and fixed-spectra, nadir-viewing techniques with resolutions of 0.1 cm^{-1} or better. Balloon-and Shuttle-borne experiments should be performed to study the effects of instrument noise and background fluctuations on data inversion and to determine the utility of simultaneously obtained nadir- and limb-viewing data. (19 refs.)

73946 Complementary code properties for MST radar observations. K.Wakasugi, M.Matsuo (Kyoto Inst. of Technol., Kyoto, Japan).
Mem. Fac. Ind. Arts Kyoto Tech. Univ. Sci. & Technol. (Japan), vol.31, p.31-9 (Dec. 1982). [received: May 1983]
Complementary code properties are discussed for the application to MST (mesosphere-stratosphere-troposphere) radar observations of the turbulent atmosphere. Sidelobe levels are estimated in connection with the target fluctuations and the radar system parameters. Optimized sequences of complementary codes are investigated, which maximize the sidelobe suppression and minimize the peak sidelobe when applied to MST radar observations. (10 refs.)

73947 Design of a receiving apparatus for medium frequency broadcast waves at night time. M.Mambo, T.Fukami, I.Nagano, Y.Kagawa, S.Takagi, S.Morita (Kanazawa Univ., Kanazawa, Japan).
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.121-9 (Nov. 1982). In Japanese.
Experimental studies on the short distance wave propagation at night through the ionosphere have apparently not been reported to date. In this paper, an apparatus is designed to measure the intensities of medium frequency waves in Japan at night. This apparatus has the following characteristics; (1) Each antenna is a tuned shield loop antenna, and the ratio of maximum value to minimum value of the directive pattern is nearly 50 dB. (2) To pick out only the carrier component in the desired broadcast wave interfered with by foreign broadcast waves, a receiving set with very narrow band width of 6.25 Hz has been designed by means of adding a high stable frequency signal to the terminal of the antenna. (3) The measuring equipment is set in a constant temperature oven of nearly 40°C in order to keep a constant gain for the variation of temperature. (4) The statistical calculations of fading data observed by 4 receiving sets are automatically made at a given period of time by using a microcomputer and their cumulative distributions are plotted on both Rayleigh and normal probability papers. (8 refs.)

73948 Ocean bottom tilt observation system. T.Hamatsuki, T.Hara, K.Sasaki, T.Fujisawa, I.Amikura, T.Kawasoe (Nippon Electric Co., Kawasaki, Japan).
NEC Res. & Dev. (Japan), no.68, p.67-74 (Jan. 1983).
A real time ocean bottom tilt observation system was developed under the supervision of the National Research Center for Disaster Prevention for use in earthquake prediction research. The system was installed in October 1981, on the sea bottom off the coast of Hiratsuka, Kanagawa Prefecture. This is the first system in the world, which detects a micro-tilt change in the sea bottom and transmits the data to a land station using submarine coaxial cable. (3 refs.)

73949 Analytical nonmetric close-range photogrammetry for monitoring stream channel erosion. R.Welch, T.R.Jordan (Dept. of Geography, Univ. of Georgia, Athens, GA, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.3, p.367-74 (March 1983).
Vertical stereopairs are recorded before and after storms with a nonmetric 35-mm camera from a platform (H=9.5 m) constructed over a gauged stream channel. Image measurements are easily undertaken on positive film enlargements with a cartographic digitizer, and provide the input x,y image coordinates required for an analytical solution. The procedures described provide accurate results and can be used to monitor stream channel erosion. Computer graphics routines provide an efficient means of constructing DTMs, contour maps, and three-dimensional displays of changes in evaluation due to storm runoff. (12 refs.)

73950 Sonar location system for freely floating buoys. I.G.Bird (Div. of Atmospheric Phys., CSIRO, Mordialloc, Australia).
Rev. Sci. Instrum. (USA), vol.54, no.5, p.626-9 (May 1983).
A RF interrogated sonar location system for freely floating buoys is described: The location of an array of up to three buoys may be determined on an almost continuous basis with a radius of 500 m from a shipboard monitoring station. Location accuracy of typically ±0.5 m at 200-m range, low cost, and ease of operation are the major features of the system. (9 refs.)

73951 Evaluation of the spectral resolution of optical equipment for measuring minor gas components of the atmosphere. A.V.Polyakov, Yu.M., Yu.M.Timofeev (Leningrad State Univ., Leningrad, USSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.81-6 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.102-6 (1982).
Simple nomograms are proposed and described which on the basis of data on parameters of the fine structure and concentrations of minor gas components make it possible to determine the spectral resolution of satellite, balloon, and aircraft instruments. Examples of using the nomograms are given. (9 refs.)

73952 Possibility of determining the temperature profile of the atmosphere by the acoustic sounding method. A.Ya.Bogushevich, N.P.Krasnenko (Inst. of Atmospheric Optics, Acad. of Sci., USSR).
Sov. Meteorol. & Hydrol. (USA), no.3, p.87-91 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.3, p.106-10 (1982).
A method of sounding the temperature profile of the atmosphere by a bistatic acoustic radar based on the temperature dependence of the sound velocity is examined. An analysis of the main measurement error shows the possibility of determining the temperature profile to heights of 300-500 m with an acceptable accuracy. (6 refs.)

Determination of trace amounts of phosphate in river water by flow-injection analysis .... See Entry 73391

Nuclear waste repository characterization: a spatial estimation/identification approach .... See Entry 73501

Subterranean gravity and other deep hole geophysics .... See Entry 73704

Gravimetric terrain corrections in western Canada .... See Entry 73705

The geometric correction of LANDSAT-type imagery using perturbation techniques .... See Entry 73708

Magnetometer arrays and geodynamics .... See Entry 73722

The velocity anisotropy of rock mass and location accuracy of mining tremors .... See Entry 73725

Seismic event discrimination .... See Entry 73729

Test ban treaty verification with regional data—a review .... See Entry 73730

Estimating the yield of underground nuclear explosions .... See Entry 73731

Application of arrays in the detection, location, and identification of seismic events .... See Entry 73733

An application of syntactic pattern recognition to seismic discrimination .... See Entry 73744

Design of matched filters and related frequency selective filters for the detection of teleseismic events .... See Entry 73745

Rapid F-K migration of zero offset marine reflection data ......See Entry 73747

Gulf Stream meanders: observations on propagation and growth ......See Entry 73816

Radium 228 as a tracer of basin wide processes in the abyssal ocean ......See Entry 73827

Sidescan sonar recognition of subaqueous landforms in Loch Earn, Scotland ......See Entry 73849

Description of river runoff at several sites by the multivariate canonical expansion method ......See Entry 73851

An interpolation method of randomly distributed atmospheric data in the height-time domain ......See Entry 73858

Statistical properties of the dual-polarization differential reflectivity (Z_{DR}) radar signal ......See Entry 73867

Probabilistic cluster labeling of imagery data ......See Entry 73917

Edge and line detection in multidimensional noisy imagery data ......See Entry 73918

A two step linear statistical technique using leaps and bounds procedure for retrieval of geophysical parameters from microwave radiometric data ......See Entry 73919

94.00 AERONOMY AND SPACE PHYSICS

94.10 PHYSICS OF THE NEUTRAL ATMOSPHERE

(for planets, see 96.30)

73953 **Resonant extinction of lidar returns from the alkali metal layers in the upper atmosphere.** D.M.Simonich, B.R.Clemesha.
Appl. Opt. (USA), vol.22, no.9, p.1387-9 (1 May 1983).
Resonant extinction is shown to have a small but significant effect on lidar returns from upper atmospheric sodium. An equation to correct for it is developed, and the magnitude of the correction for broadband and monochromatic lasers is discussed. (12 refs.)

An experiment of infrared spectroscopy for the first Spacelab mission ......See Entry 73927

94.20 PHYSICS OF THE IONOSPHERE

(for planets, see 96.30)

73954 **On winter anomaly of short radio waves.** P.I.Velinov, V.A.Vlaskov, N.A.Smirnova (Geophys. Inst., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.1, p.73-6 (1983). In French.
The absorption of short radio waves in the atmosphere takes place mainly between 75 km and 95 km in height. During the winter at temperature latitudes the degree of absorption fluctuates by a large factor, and frequently it is much greater than what is predicted by a simple theory related only to solar illumination. An extended theory is discussed which takes into account the temperature and also minor chemical constituents (water vapour, oxides of nitrogen and ozone). The extended theory is in much better agreement with typical experimental results. (14 refs.) *G.F.F.*

73955 **Quantitative study of substorm-associated VLF phase anomalies and precipitating energetic electrons.** T.Kikuchi, D.S.Evans (Radio Res. Labs., Min. of Posts & Telecommunications, Tokyo, Japan).
J. Radio Res. Lab. (Japan), vol.29, no.128, p.183-99 (Nov. 1982). [received: May 1983]
The phase anomalies associated with substorms were observed on VLF signals propagating on trans-auroral paths (transmitters at OMEGA-ALDRA (13.6 kHz), GBR (16.0 kHz) and OMEGA-NORTH DAKOTA (13.6 kHz) which were continually received at Inubo, Japan during the events on November 13, 1979. Detailed comparisons are made between these phase anomalies and geomagnetic bays, and quantitative relations are obtained with precipitating energetic electrons ($E>30$, >100 and >300 keV) detected onboard the TIROS-N and NOAA-6 satellites. It is concluded that two types of VLF phase anomalies exist which in turn are associated with two phases in the history of energetic electron precipitation into the atmosphere. The first type of phase anomaly is associated with direct injection of energetic electrons into the outer magnetosphere and atmosphere which, in turn, is completely correlated in time with development of the auroral electrojet current system. The second type arises from energetic electrons which subsequently precipitate from a trapped electron population and has a delayed onset and prolonged duration. An excellent quantitative correlation is obtained between the logarithm of the electron flux and the magnitude of the phase anomaly on the OMEGA-ALDRA signal. From the local time characteristics of this quantitative relation, it is deduced that the electrons with $E>300$ keV are the main source of D-region ionization responsible for the VLF phase anomaly. (18 refs.)

73956 **Limiting polarisations for ionospheric downgoing waves at low and medium frequencies.** M.Mambo, I.Nagano, Y.Kagawa (Kanazawa Univ., Kanazawa, Japan).
Mem. Fac. Technol. Kanazawa Univ. (Japan), vol.15, no.2, p.113-19 (Nov. 1982). In Japanese.
The limiting polarisation, which is the polarisation required by a downgoing characteristic wave to make its polarisation constant by coupling at the bottom of the ionosphere, is studied. The limiting polarisations of vertically downgoing waves in two electron density profiles, that is, a day time profile with a hollow in the D layer and a night time profile, are calculated at low and medium frequencies by a full wave method and compared with the results obtained by magnetoionic theory and the foreign experimental results. The results obtained can be summarized as follows. For the night time profile at medium frequency, the axis ratios of the limiting polarisations and the directions of the major axes of the limiting polarisations calculated by the full wave method agree with those obtained by magnetoionic theory. For day time profile at low frequency, they agree qualitatively with the foreign experimental results but are different from those obtained by magnetoionic theory. (25 refs.)

73957 **Radiation from long conducting tethers moving in the near-Earth environment.** V.Belcastro, P.Veltri (Dipartimento di Fisica, Univ. della Calabria, Calabria, Cosenza, Italy), M.Dobrowolny.
Nuovo Cimento C (Italy), vol.5C, ser.1, no.5, p.537-60 (Sept.-Oct. 1982). [received: May 1983]
Considers the problem of radiation of electromagnetic waves from a long conducting tether moving in the ionosphere. Radiation from low-frequency plasma modes, from ULF up to the electron cyclotron frequency is considered. Both the case of a passive tether (no generator) and that of a tether driven as an antenna are considered. (12 refs.)

Electrical conductivity for radio-frequency fields in strongly magnetized plasmas with density fluctuations ......See Entry 71696

Electrostatic modes in a magnetized plasma with a longitudinal density gradient ......See Entry 71718

On reflexion and trapping of upper-hybrid waves ......See Entry 71719

The thermal self-focusing of a wave beam in an under dense plasma. I. The wave spectrum ......See Entry 71724

Design of a receiving apparatus for medium frequency broadcast waves at night time ......See Entry 73947

Plasmaspheric ELF hiss observed by ISIS satellites ......See Entry 73960

Range distribution of sporadic meteors and sunrise ......See Entry 74054

94.30 PHYSICS OF THE MAGNETOSPHERE

(for planets, see 96.30)

73958 **Linear transformation of a slow extraordinary wave into a fast wave close to the upper hybrid resonance. Earth's radio emission in the kilometric range.** Ya.N.Istomin, O.A.Pokhotelov.
Fiz. Plazmy (USSR), vol.9, no.2, p.250-3 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
A new mechanism is suggested for the generation of the kilometric radio emission of the Earth, based on the linear conversion of a slow extraordinary wave into a fast wave close to the upper hybrid resonance. It is shown that such a conversion is most effective in a region of reduced plasma density associated with the formation in the auroral magnetosphere of a double electric layer. The conclusions of the theory are said to be in agreement with the results of observations of the kilometric radio emission of the Earth. (10 refs.) *A.G.C.*

73959 **Alfven sweep-maser.** S.V.Polyakov, V.O.Rapoport, V.Yu.Trakhtengerts.
Fiz. Plazmy (USSR), vol.9, no.2, p.371-7 (March-April 1983). In Russian. English translation in: *Sov. J. Plasma Phys. (USA)*
A theory of the Alfven sweep maser is constructed, in which the role of active material is played by energetic protons of the radiation belts, and the resonator is a magnetic tube of force bounded at the ends by the ionospheres of conjugate hemispheres. It is shown that resonance properties of the coefficient of reflection R(w) of the Alfven waves from the ionosphere and of the relationship of R(w) to the flow of particles pouring out lead to the peaking conditions for the formation of an Alfven maser by sweeping up particles. The development of the theory enables the basic properties of a class of geomagnetic pulsations in the range Pc 1 ('pearls') to be explained. (8 refs.) *A.G.C.*

73960 **Plasmaspheric ELF hiss observed by ISIS satellites.** T.Ondoh, Y.Nakamura, S.Watanabe, K.Aikyo, T.Murakami (Radio Res. Labs., Min. of Posts & Telecommunications, Tokyo, Japan).
J. Radio Res. Lab. (Japan), vol.29, no.128, p.159-81 (Nov. 1982). [received: May 1983]
Describes characteristics of ELF hiss electric fields observed in the topside ionosphere by using electric field frequency-time spectra (50 Hz-30 kHz) received from ISIS-1 and -2 at Kashima station, Japan. The characteristics of ELF hiss obtained from ELF electric field data of ISIS-1 and -2 are compared with those of the plasmaspheric hiss and of the inner zone hiss. The differences between the results are discussed. (16 refs.)

Quantitative study of substorm-associated VLF phase anomalies and precipitating energetic electrons ......See Entry 73955

94.40 COSMIC RAYS

94.40C Origin and propagation outside the solar system

73961 **Non-LTE astrophysics and the origin of high energy cosmic rays.** S.A.Colgate (Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.96, p.306-12 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
The most startling aspect of the Universe is the departure from the nonuniform, nonthermodynamic equilibrium state. Mass concentrations and high energy electromagnetic quanta and particles are the primary examples. Of these various departures the extremum of nonexplained phenomena is still the acceleration of cosmic rays. The usual explanation involving multiple mechanisms contributing to various regions of the spectrum is suggested as most unlikely. In particular, the suggestion that the acceleration of the very highest energy cosmic rays is by distant active galactic nuclei is shown to be untenable because of photon particle interactions. (8 refs.)

73962 **A method for determining the age of cosmic rays in the galaxy.** Huang Yong-nian (Inst. of Space Phys., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.79-85 (Jan.-March 1983). [received: May 1983]
Presents a way to determine the age of cosmic rays in the galaxy by using the data on the ratio of the abundance of manganese to iron from the Danish-French isotope instrument on board HEAO-3. The leaky-box model and the exponential path-length distribution have been adopted. (6 refs.)

Solrad 11 observations of the far-ultraviolet background ......See Entry 74183

94.40E Interplanetary propagation and effects

Temporal variations of nucleonic abundances in solar flare energetic particle events. I. Well-connected events ......See Entry 74061

94.40H Energetic solar particles and photons

Solar type II radio emission and the shock drift acceleration of electrons .... See Entry 74060

Temporal variations of nucleonic abundances in solar flare energetic particle events. I. Well-connected events .... See Entry 74061

94.40L Composition and energy spectra

73963 Pion-to-proton ratio for unaccompanied high-energy cosmic-ray hadrons at mountain altitude using transition-radiation detector. R.W.Ellsworth, A.S.Ito, J.R.MacFall, F.Siohan, R.E.Streitmatter, S.C.Tonwar, P.R.Viswanath, G.B.Yodh (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Phys. Rev. D (USA), vol.27, no.9, p.2041-55 (1 May 1983).
A transition-radiation (TR) detector, consisting of 24 modules of styrofoam radiators and multiwire proportional chambers, and an ionization calorimeter have been used to measure the pion-to-proton ratio among the unaccompanied cosmic-ray hadrons at a mountain altitude of 730 g cm^{-2}. Using the characteristics of the TR detector obtained from calibrations with particle beams at accelerators, the π/p ratio has been determined for cosmic-ray hadrons as $\pi/p=0.96\pm0.15$ for hadron energy$=400-800$ GeV, and $\pi/p=0.45\pm0.25$ for energy >800 GeV. Monte Carlo simulations of hadron cascades in the atmosphere using the approximate criterion of unaccompaniment suggest that the observed π/p ratio as well as the previously reported neutral-to-charge ratio can be understood by assuming a value of about $^1/_3$ for the charge exchange in nucleon-air-nucleus inelastic interactions at energies above 400 GeV. (33 refs.)

A method for determining the age of cosmic rays in the galaxy .... See Entry 73962

Temporal variations of nucleonic abundances in solar flare energetic particle events. I. Well-connected events .... See Entry 74061

94.40N Extensive air showers

Pion-to-proton ratio for unaccompanied high-energy cosmic-ray hadrons at mountain altitude using transition-radiation detector .... See Entry 73963

94.40T Muons and neutrinos

73964 Underground neutrino astronomy. D.N.Schramm (Univ. of Chicago, Chicago, IL, USA).
AIP Conf. Proc. (USA), no.96, p.318-23 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
A review is made of possible astronomical neutrino sources detectable with underground facilities. Comments are made about solar neutrinos and gravitational collapse neutrinos, and particular emphasis is placed on ultra-high energy astronomical neutrino sources. An appendix mentions the exotic possibility of monopolonium. (16 refs.)

Cosmic ray physics underground: some puzzles .... See Entry 73997

Solrad 11 observations of the far-ultraviolet background .... See Entry 74183

94.60 INTERPLANETARY SPACE

(see also 96.60 Solar physics)

73965 Helios 1 + Helios 2: a summary of IMF observations performed in the inner solar system during 1975-1981. U.Villante (Istituto di Fisica Univ. di L'Aquila, L'Aquila, Italy), F.Mariani, R.Cirone.
Nuovo Cimento C (Italy), vol.5C, ser.1, no.5, p.497-506 (Sept.-Oct. 1982). [received: May 1983]
The experimental observations performed by Helios 1 and Helios 2 spacecraft can be used to monitor the IMF conditions in the inner solar system ($0.3\leq r\leq0.6$ A.U.) over many years. The field orientation closely corresponds to theoretical predictions and the histograms of the distributions of the angular elements are possible more peaked around the expected values than those obtained at greater heliocentric distances. The field behaviour does not show any clear long-term variation and only supports some evidence for a field modulation in the rising part of the new solar cycle. (19 refs.)

Electromagnetic solitons with trapped particles in an ion-beam plasma .... See Entry 71716

Charge exchange in solar wind-cometary interactions .... See Entry 74038

94.80 AEROSPACE FACILITIES AND TECHNIQUES; SPACE RESEARCH

(see also 87.65 Aerospace biophysics and medical physics)

73966 Rendezvous with Halley's Comet. R.Reinhard (ESA, Noordwijk, Netherlands).
Umschau (Germany), vol.83, no.5, p.144-9 (4 March 1983). In German.
Halley's Comet, a comet with a 76 year period, is approaching the Sun and the Earth again. The European Space Agency (ESA) wishes to make use of this rare opportunity and will send a space probe to intercept the comet in March 1986. The rendezvous is described. (3 refs.)

73967 The ERS-1 programme of the European space agency. A.Haskell (Earth Obs. Programme Office, ESA, Toulouse, France).
ESA J. (Netherlands), vol.7, no.1, p.1-13 (1983).
Describes this programme, its status, planning and objectives and provides a summary of the capabilities of the first remote-sensing satellite, ERS-1, and its ground segment. (6 refs.)

73968 Astronomy—the next space race. N.Henbest.
New Sci. (GB), vol.97, no.1351, p.896-900 (31 March 1983).
Discusses the future of space astronomy and some of the satellites planned for the next decade. (no refs.)

73969 Satellite performance reference chart 1983. W.L.Morgan.
Satell. Commun. (USA), vol.7, no.3, p.36-9 (March 1983).
Presents the third annual chart recording the state of the satellite communications business. A comparison of the three charts reveals a surprisingly rapid increase in the variety of satellites; in the quantities in each category, and even more significantly, in the radiated power from the satellites. This power increase has led to substantial reductions in cost and size of earth stations. It has also permitted a variety of new services and lays the groundwork for still additional capabilities as the power in the beams is increased further. (no refs.)

Configuration design of a closed-loop, pseudogravitational, environmental research facility in low Earth orbit .... See Entry 73671

The geometric correction of LANDSAT-type imagery using perturbation techniques .... See Entry 73708

Probabilistic cluster labeling of imagery data .... See Entry 73917

Edge and line detection in multidimensional noisy imagery data .... See Entry 73918

A two step linear statistical technique using leaps and bounds procedure for retrieval of geophysical parameters from microwave radiometric data .... See Entry 73919

A multiple beam synthetic aperture radar design concept for geoscience applications .... See Entry 73939

Attitude perturbations of the Giotto spacecraft in the dust cloud of comet Halley .... See Entry 74042

95.00 FUNDAMENTAL ASTRONOMY AND ASTROPHYSICS, INSTRUMENTATION AND TECHNIQUES AND ASTRONOMICAL OBSERVATIONS

95.10 FUNDAMENTAL ASTRONOMY

Calculation of ephemerides for libration points .... See Entry 73981

Catalogue of 20457 star positions obtained by photography in the declination zone $-48°$ to $-54°$ (1950) .... See Entry 73999

The Asiago Catalogue of Quasi Stellar Objects .... See Entry 74001

Occultations by possible rings in Saturn's outer magnetosphere: 1982-1985 .... See Entry 74035

New Comet Sugano-Saigusa-Fujikawa 1983e .... See Entry 74040

Comet IRAS-Araki-Alcock 1983d .... See Entry 74041

Comet IRAS-Araki-Alcock (1983d) .... See Entry 74043

Comet IRAS-Araki-Alcock (1983d) .... See Entry 74044

Comet IRAS-Araki-Alcock (1983d) .... See Entry 74045

Comet IRAS-Araki-Alcock (1983d) .... See Entry 74046

Comet IRAS-Araki-Alcock (1983d) .... See Entry 74047

Comet IRAS-Araki-Alcock (1983d) .... See Entry 74049

Comet Sugano-Saigusa-Fujikawa (1983e) .... See Entry 74051

Comet Sugano-Saigusa-Fujikawa (1983e) .... See Entry 74053

Possible supernova in NGC 4258 .... See Entry 74093

Further observations of the long-period binary pulsar PSR 0820+02 .... See Entry 74095

PSR 1937+214 .... See Entry 74098

Astrometric studies of ten double or suspected multiple systems from plates taken with the Sproul 61-cm refractor .... See Entry 74112

95.10C Celestial mechanics

(for dynamics and kinematics of stellar systems, see 98.10)

73970 On the bifurcations of a certain family of periodic orbits. D.C.Heggie (Inst. of Astron., Cambridge, England).
Celestial Mech. (Netherlands), vol.29, no.3, p.207-14 (March 1983).
In their numerical study of a particular family of periodic orbits in a certain potential, Contopoulos and Zikides (1980; Contopoulos, 1981) have calculated numerically successive values of the energy h at which the family becomes unstable. They showed that the ratio of successive values of $h-h_{esc}$, where h_{esc} is the energy of escape, is approximately 9.22. The author shows that the limiting ratio as $h\rightarrow h_{esc}$ is $\exp(\pi/\sqrt{2})$ in this problem, and that the limiting ratio for bifurcation of this type varies from one problem to another. (6 refs.)

73971 On the stability of close binaries in hierarchical three-body systems. I.W.Walker (Dept. of Astron., Univ. of Glasgow, Glasgow, Scotland).
Celestial Mech. (Netherlands), vol.29, no.3, p.215-28 (March 1983).
The Hill-type stability of general hierarchical three-body systems is examined analytically in the case where the total mass of the binary is small in comparison to the mass of the external body. This is compared with results derived by Szebehely (1978), Markellos and Roy (1981) in the Planet-Satellite-Sun case of the circular restricted three-body problem. It is demonstrated how the Hill-type stability is affected by the sense of revolution of the binary. The effect of the difference in longitudes of the bodies in their orbits is also examined. (7 refs.)

73972 The reduction to the rotation for planar perturbed Keplerian systems. A.Deprit (NBS, Washington, DC, USA).
Celestial Mech. (Netherlands), vol.29, no.3, p.229-47 (March 1983).
After the mean anomaly has been removed from the perturbations, the reduction Hamiltonian becomes a function over the Lie algebra determined by the infinitesimal generators associated with the dynamical symmetries of an unperturbed Keplerian system. The phase space being now the group SO(3), average motions consist of rotations, and the normalized Hamiltonian serves as a Morse function whose critical points determine the intrinsic topology of the perturbed system. (26 refs.)

73973 Solution of equations of problem of motion of a heavy rigid body about a fixed point in the Kowalevskaya's case using θ-function. F.M.El-Sabaa (Dept. of Math., Ain-Shams Univ., Cairo, Egypt).
Celestial Mech. (Netherlands), vol.29, no.3, p.249-53 (March 1983).
Equations of motion of a heavy rigid body about a fixed point in the Kowalevskaya's case are reduced to those of the plane motion of a particle under the action of potential force. In the new form of the equations of motion, elliptic coordinates λ, μ are used, and the motion has taken the Hamilton-Jacobi form. (4 refs.)

73974 The rotation number of bounded orbits in a central field. F.Puel (CNRS, Equipe de Recherche Associee, Obs. de Besancon, Besancon, France).
Celestial Mech. (Netherlands), vol.29, no.3, p.255-66 (March 1983).
After reviewing known results on bounded motions in a central field and on the angle between two consecutive apocenters the author investigates the limit of the orbits as the pericenter tends to the origin. A 'deflection' of the almost rectilinear orbits is found which depends on the shape of the potential at the origin. The author studies the rotation numbers of all bounded motions in a field homogeneous in r. Finally on a few examples the author shows how to represent the set of bounded motions in an inhomogeneous field. (10 refs.)

73975 Stability criteria in many-body systems. V. On the totality of possible hierarchical general four-body systems. I.W.Walker, A.E.Roy (Dept. of Astron., Univ. of Glasgow, Glasgow, Scotland).
Celestial Mech. (Netherlands), vol.29, no.3, p.267-94 (March 1983).
For pt.IV see ibid., vol.29, no.2, p.149-78 (1983). The stability of hierarchical many-body dynamical systems has been considered in terms of parameters which are a measure of the perturbation imposed on the disturbed Keplerian orbit of each member of a system by the other bodies present. If these parameters are small enough then the initial hierarchical order will be undisturbed for some time. In the light of this criterion the appropriate parameters for the general four-body problem are considered. Two distinct hierarchical arrangements of four-body systems are possible; these are classified and an examination of the relevant stability parameters is made in each case. It is shown how regions may be determined within which real four-body systems can exist and may be stable. It is also shown how the various types of possible systems within these regions may be identified. (7 refs.)

73976 On the double averaged three-body problem. M.Sidlichovsky (Astron. Inst., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Celestial Mech. (Netherlands), vol.29, no.3, p.295-305 (March 1983).
The Hamiltonian of three point masses is averaged over fast variable l and l' (mean anomalies). The problem is non-planar and it is assumed that two of the bodies form a close pair (stellar three-body problem). Only terms up to the order of $(a/a')^4$ are taken into account in the Hamiltonian, where a and a' are the corresponding semi-major axes. Employing the method of elimination of the nodes, the problem may be reduced to one degree of freedom. Assuming in addition that the angular momentum of the close binary is much smaller than the angular momentum of the motion of the binary around a third body, the author solves the equation for the eccentricity changes in terms of the Jacobian elliptic functions. (6 refs.)

73977 Generalization of Szebehely's equation. G.Bozis (Dept. of Theoretical Mech., Univ. of Thessaloniki, Thessaloniki, Greece).
Celestial Mech. (Netherlands), vol.29, no.4, p.329-34 (April 1983).
Szebehely's partial differential equation for the force function $U=U(x,y)$ which gives rise to a given family of planar orbits $f(x,y)=\text{Constant}$ is generalized to account for velocity-dependent potentials $V^*=V^*(x,y,\dot{x},\dot{y})$. The new partial differential equation is quasi-linear and of the first order. An example is given and a comparison is made of the two equations. (7 refs.)

73978 Note on the relation between the equinox and Guinot's non-rotating origin. S.Aoki, H.Kinoshita (Tokyo Astron. Obs., Univ. of Tokyo, Tokyo, Japan).
Celestial Mech. (Netherlands), vol.29, no.4, p.335-60 (April 1983).
Shows that the non-rotating origin introduced by Guinot (1979) is nothing but a departure point on the movable equatorial plane, and discusses that, even if this is introduced, the uncertainty of determining the equinox correction cannot be avoided. A difficulty still remains, furthermore, when one takes into account nutational effect, since the (true) departure point is not fixed but moves in RA direction on the equator secularly and periodically with respect to space. The authors discuss thoroughly the interrelation between old and new concepts, and propose an exact treatment sufficient enough for the precise requirements. (23 refs.)

73979 Lagrange variational equations from Hori's method for canonical systems. W.Sessin (Dept. de Astron., Inst. Tecnologico de Aeronautica, Sao Jose dos Campos, Sao Paulo, Brazil).
Celestial Mech. (Netherlands), vol.29, no.4, p.361-6 (April 1983).
Hori (1966), in his method for canonical systems, introduces a parameter τ through an auxiliary system of differential equations. The solutions of this system depend on the parameter and constants of integration. Lagrange variational equations for the study of the time dependence of this parameter and of these constants are derived. These variational equations determine how the solutions of the auxiliary system will vary when higher order perturbations are considered. A set of Jacobi's canonical variables may be associated to the constants and parameter of the auxiliary system that reduces Lagrange variational equations to a canonical form. (3 refs.)

73980 Impossibility of the capture of retrograde satellites in the restricted three-body problem. K.Tanikawa (Internat. Latitude Obs. of Mizusawa, Iwate, Japan).
Celestial Mech. (Netherlands), vol.29, no.4, p.367-402 (April 1983).
Impossibility of the capture of retrograde satellites is proved in the framework of the circular planar restricted three-body problem. Motion of the third body is described in Birkhoff's variables. First, various kinds of retrograde orbits around one of the primaries are defined. Among them are captured retrograde orbits and retrograde satellite orbits. Second, the surface of section and surface transformation are defined in the three dimensional manifold, in which the motion of the third body is possible for a fixed value of the Jacobi constant. Third, the surface transformation is shown to be homeomorphic and measure-preserving. Finally, with the use of these properties of surface transformation, impossibility of the capture is shown. (5 refs.)

73981 Calculation of ephemerides for libration points. L.G.Luk'yanov, G.L.Suchkin, G.I.Shirmin (P.K. Shternberg State Astron. Inst., USSR).
Sol. Syst. Res. (USA), vol.16, no.3, p.147-52 (July-Sept. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.3, p.183-9 (July-Sept. 1982). [received: April 1983]
A short review is given of papers that are devoted to the astronomical applications of the Lagrangian solutions of the restricted three-body problem and to observations of objects in the vicinity of the libration points of various bodies of the Solar System. Equations are shown for calculating the equatorial and horizon spherical coordinates of the libration points of the Earth-Moon and Sun-Earth systems for specific coordinates of the Moon and Sun. (19 refs.)

About the non-existence of additional analytical integral in the problem of a satellite's motion under the gravitational attraction of a triaxial rigid body ....See Entry 74005

95.30 FUNDAMENTAL ASPECTS OF ASTROPHYSICS

73982 Transfer of polarized radiation in astronomical masers. L.R.Western, W.D.Watson (Univ. of Illinois, Urbana, IL, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.849-59 (15 May 1983).
Equations are obtained that describe the transfer of the linearly polarized radiation that occurs naturally in two- and three-dimensional astronomical masers. Although restricted, the geometries to which these equations apply to include disks, spheres, and shells, the properties of which will provide a useful indication of what might be expected for less idealized geometries. The equations are derived for circumstances in which magnetic fields can be ignored. The transfer equations presented here include both polarization and intersecting maser rays. The transfer equations are in a form that is amenable to the numerical integrations which must be performed to determine the net linear polarizations and apparent sizes that result for actual maser models. It can, however, be seen from the transfer equations themselves that the growth of particular linear polarizations can be strongly preferred in masering regions that are not isotropic. The possibility then exists that substantial linear polarization can be produced by natural asymmetries in the geometry without the need for magnetic fields or pumping mechanisms that select magnetic substates. (11 refs.)

73983 Energy dynamics in stressed magnetic fields: the filamentation and flare instabilities. G.Van Hoven, R.S.Steinolfson, T.Tachi (Dept. of Phys., Univ. of California, Irvine, CA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.860-4 (15 May 1983).
The thermal and tearing instabilities are believed to be the two primary temperature modification mechanisms in sheared astrophysical magnetic fields. The former gives rise to the formation of cool filaments and the latter to the release of magnetic energy. It has long been known that these processes are interrelated, most conspicuously in the case of the solar corona where prominences often precede flares within the same magnetic structure. It is also clear, from first principles, that the energy transport underlying the thermal instability should have a strong effect on the resistivity which facilitates magnetic tearing, and that the energy release of the latter should effect the temperature drop of the former. Some results of the first calculations which attempt to unify the dynamic treatment of these two coexisting instabilities are described. Growth rates as a function of resistivity, and examples of the primary mode structures are provided, along with a discussion of some critical aspects of the interaction of these two astrophysical energy flux mechanisms. (13 refs.)

73984 On the first-order smoothing expression for the α-effect in dynamo theory. B.R.Durney (Sacramento Peak Obs., Sunspot, NM, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.822-4 (15 April 1983).
The well-known expression for the α-term in mean field electrodynamics derived by Krause (1976) does not vanish in the Boussinesq approximation if curvature effects are neglected. The author derives an expression for α which satisfies this constraint and discusses its uniqueness. (26 refs.)

73985 Decay of long-lived particles in the early Universe. J.Silk (Dept. of Astron., Univ. of California, Berkeley, CA, USA), A.Stebbins.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.1-12 (1 June 1983).
Radiative decay of massive fermions can distort the cosmic background radiation. Constraints are derived on the masses and lifetimes of such particles which decoupled when the effective number of species in equilibrium was large (~ 50). These have specific significance for particles predicted by supersymmetry theories and for right-handed neutrinos. Implications for galaxy formation theory are noted. (22 refs.)

73986 Relativistic thermal plasmas: effects of magnetic fields. S.Araki (Dept. of Phys., MIT, Cambridgbe, MA, USA).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.49-56 (1 June 1983).
Investigates the equilibria of relativistic, thermal plasmas, taking into account electron-positron creation and annihilation, photon production by internal processes, and photon production by a magnetic field B. Inclusion of the latter extends previous work on such plasmas. Synchrotron photons produced by B are Compton scattered up to high energies, where they produce pairs or emerge as X-rays or γ-rays. Solutions are determined by three dimesionless parameters, which may be taken as the dimensionless temperature, $T_* \equiv kT/mc^2$; the energy spectral index, $x \equiv \ln(1/\tau_{th})/\ln(16T_*^2)$, where τ_{th} is the Thomson scattering depth; and a magnetic parameter, $\beta(B, T_*, s, R)$, where R is the size of the medium. (14 refs.)

73987 Effects of the Kelvin-Helmholtz surface instability on supersonic jets. P.E.Hardee (Dept. of Phys. & Astron., Univ. of Alabama, University, AL, USA).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.94-101 (1 June 1983).
Performs an exact numerical calculation of the linear growth and phase velocity of Kelvin-Helmholtz unstable wave modes on a supersonic jet of cylindrical cross section. An expression for the maximally unstable wavenumber of each wave mode is found. Provided a sharp velocity discontinuity exists, all wave modes are unstable. A combination of rapid jet expansion and velocity shear across a jet can effectively stabilize all wave modes. The more likely case of slow jet expansion and of velocity shear at the jet surface allows wave modes with maximally unstable wavelength longer than or on the order of the jet radius to grow. The relative energy in different wave modes and effect on the jet is investigated. Energy input into a jet resulting from surface instability is discussed and the effect on source morphology is considered. (25 refs.)

73988 Magnetic fields in astrophysics. R.D.Blandford (Theoretical Astrophys., Caltech, Pasadena, CA, USA).
Astron. J. (USA), vol.88, no.3, p.245-52 (March 1983).
Magnetic fields play many important roles in interpretative models of astronomical phenomena. They can provide powerful diagnostics of the physical conditions within active objects. They may mediate and collimate the energy release from a deep gravitational potential well. On a microscopic level, they may control the transport properties of astrophysical plasmas with large-scale thermal and dynamical consequences. Some of these facets of the behaviour of magnetic fields are illustrated with examples drawn mainly from contemporary high-energy astrophysics. In particular, the author presents the case that most double radio sources are powered by the electromagnetic or hydromagnetic extraction of energy from a spinning massive black hole and accretion disk and subsequently collimated by the pinching action of toroidal field wrapped around the jet. The origin of neutron star magnetic fields is also discussed and it is argued that the magnetization can be generated thermoelectrically by the heat flux escaping from the interior of the star. (35 refs.)

73989 Stability of an astrophysical plasma near the onset of electron runaway. J.S.Kaastra (Sterrekundig Inst., Rijksuniv. Utrecht, Utrecht, Netherlands).
J. Plasma Phys. (GB), vol.29, pt.2, p.287-98 (April 1983).
The time-dependent behaviour of a homogeneous plasma in a weak electric field near the onset of runaway of electrons is studied for astrophysical applications. The relativistic Boltzmann equation is used to calculate the particle distribution function. It is shown that the plasma is stable against electric field fluctuations in the onset region for runaway, provided that the global behaviour of the system is determined by the magnetic field structure. (10 refs.)

73990 On frequency waves. Ting Ou-Yang (Inst. of Geophys., State Seismological Bur., Beijing, China).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.457-63 (May 1983).
A new type of wave existing in the frequency domain is deduced and named a frequency wave. For a homogeneous medium, the authors have obtained the approximate and rigorous solutions of a frequency shift equation for plane radiation under some special, one-sided or two-sided frequency shift conditions. (3 refs.)

Bianchi type-I models with conformally invariant scalar field ..See Entry 69945

Cosmological character of the Higgs field ....See Entry 70268

Constraint on the photino mass from cosmology ....See Entry 70275

Gauge hierarchy generation and cosmology in locally supersymmetry GUTS ....See Entry 70278

Cosmological-type constant derived in a unified field theory ....See Entry 70290

Supersymmetric grand unified theories and cosmology ....See Entry 70291

Thermodynamics of extended hadrons with baryon number .....See Entry 70342

Fluorescence excitation of CO in comets ....See Entry 70848

Oscillator strengths and collision strengths for S II ....See Entry 71016

Subterranean gravity and other deep hole geophysics ....See Entry 73704

Underground neutrino astronomy ....See Entry 73964

Charge exchange in solar wind-cometary interactions ....See Entry 74038

Microwave and hard X-ray imaging of a solar flare on 1980 November 5 ....See Entry 74058

The minimum period and the gap in periods of cataclysmic binaries ....See Entry 74073

Effect of a single coordinate system of curvature on the properties of the boundary between *R*- and *T*-regions and the energy-momentum tensor ....See Entry 74089

Nonradial *g*-mode oscillations of warm neutron stars ....See Entry 74099

Temperature dependent gravitational constant and black hole physics ....See Entry 74102

Post-Newtonian gravitational radiation of a system of two compact objects in the field theory of gravitation ....See Entry 74117

Intergalactic shock waves ....See Entry 74157

A note on the formation of clusters of galaxies ....See Entry 74163

Pressure collimation of supersonic radio jets ....See Entry 74167

Solrad 11 observations of the far-ultraviolet background ....See Entry 74183

The influences of massive neutrinos on clustering in the early Universe ....See Entry 74188

The renormalized coupling constant in an open static Einstein universe ....See Entry 74190

Time limit for hadronic phase transition in the big bang ....See Entry 74192

Could the metastable vacuum burn ....See Entry 74193

Formation of structure in an axion-dominated Universe ....See Entry 74194

Inflationary universe with gravity ....See Entry 74195

Vacuum energy and large-scale structure of the Universe ....See Entry 74197

95.55 ASTRONOMICAL INSTRUMENTS

73991 A chopping secondary for the 74-inch. D.T.Ellis, I.S.Glass, E.F.Sommeregger, J.D.Wilson (South African Astron. Obs., Observatory, S Africa).
Mon. Notes Astron. Soc. South Afr. (S. Africa), vol.41, no.7-10, p.81-4 (Oct. 1982). [received: April 1983]
The advantages of chopping secondary systems for infrared observations are outlined. A detailed description of the installation at Sutherland is given together with some details of its performance. (3 refs.)

73992 Images in astronomy. L.Vigroux (CEA, Saclay, France).
Recherche (France), vol.14, no.144, p.626-34 (May 1983). In French.
To observe objects which are weaker and weaker astronomers always seek to improve their observation methods. The work in the last 10 years gives rise to the need to describe a new generation of telescopes. These obtain images over practically all of the spectra of electromagnetic radiation. The development of various kinds of telescopes is outlined very briefly, together with the effects of the atmosphere on astronomy in general. Various stages in the battle against these defects are described in some detail. Then follows a section on radio astronomy—said to have given astronomers new eyes. (17 refs.) *G.V.D.*

73993 Computer systems at the Multiple Mirror Telescope. W.P.Goring (Multiple Mirror Telescope Obs., Tucson, AZ, USA).
Second Annual Phoenix Conference on Computers and Communications. 1983 Conference Proceedings, Phoenix, AZ, USA, 14-16 March 1983 (New York, USA: IEEE 1983), p.306-10
The world's third largest telescope in total light collecting area, the multiple mirror telescope (MMT) atop Mt. Hopkins in southern Arizona has the largest mirror edge-to-edge diameter of any optical telescope ever built. As integral to the success of the telescope as its mirrors, are its several computer systems, without which the MMT could not perform its state of the art observations. One computer system controls the pointing and tracking motion of the altitude over azimuth telescope mount to high precision. The 'telescope coalignment system' superposes the images from each of the telescopes in a common focal plane by tilting the telescope secondary mirrors. The third computer on the mountain controls the astronomical instrument mounted on the telescope and records the data collected by that instrument. (no refs.)

73994 Upgrading the 11-meter antenna of the National Radio Astronomy Observatory. J.W.Findlay, J.M.Payne (Nat. Radio Astron. Obs., Greenbank, WV, USA).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.55-9 part 1
The 11-meter antenna on Kitt Peak, near Tucson, Arizona, has now been in operation for more than 15 years. Many astronomers have used it to make observations at millimeter wavelengths; it is probably the most used and most successful instrument of its kind. However, it suffers from less than ideal pointing behavior and its surface accuracy has an RMS value of about 175 μm. These facts have made the instrument of little use at wavelengths less than about 2 mm (150 GHz); in particular, it cannot be used well in the atmospheric window centered on 1.2 mm wavelength (250 GHz). The telescope is in a large astrodome with a dome door just large enough to allow a 12-meter diameter reflector to see through it, so the project described is planned to increase the reflector size and make it more precise and stable. The authors give most attention to the new reflector surface and how it has been measured and set. The design of the reflector support structure and the properties of the radiometers installed on the telescope are described. (4 refs.)

73995 Radioastronomy antennas for 3K cosmic radiation measurements. P.Bielli, E.Pagana (CSELT, Turin, Italy), G.Sironi.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.503-7 part 1
Improves the radiation performance of the horn reflector antenna by corrugating the conical waveguide. Also the feeding corrugated waveguide allows one to reduce the overall size of the horn reflector since the increase of the waveguide flare angle up to 60° does not affect the electrical performance. (4 refs.)

95.65 AUXILIARY AND RECORDING INSTRUMENTS

73996 The SAAO filter-wheel spectrometer. I.S.Glass (South African Astron. Obs., Observatory, S Africa).
Mon. Notes Astron. Soc. South Afr. (S. Africa), vol.41, no.7-10, p.78-81 (Oct. 1982). [received: April 1983]
The design of an infrared spectrometer having 1% resolution and covering the range 1.2 to 4.1 μm is described. (3 refs.)

A chopping secondary for the 74-inch ....See Entry 73991

95.70 OTHER INSTRUMENTATION AND TECHNIQUES

(inc. clocks, frequency standards)

73997 Cosmic ray physics underground: some puzzles. M.R.Krishnaswamy, M.G.K.Menon, N.K.Mondal, V.S.Narasimham, B.V.Sreekantan (Tata Inst. of Fundamental Res., Bombay, India), Y.Hayashi, N.Ito, S.Kawakami, S.Miyake.
AIP Conf. Proc. (USA), no.96, p.265-72 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
A series of experiments has been carried out since 1961 at depths of 750 to 8400 hg/cm^2 in the Kolar Gold Mines and the general features of atmospheric muons and neutrinos have been studied. However, there are some problems which are incompletely understood and some of the events observed suggest the existence of new phenomena caused by unknown particles or processes. The authors point out some problems observed at these great depths which are relevant to the prompt muons in hadronic collisions; the increase of average transverse momentum in the very high energy region, muon bundles, Kolar events, large electromagnetic cascades, and so on. (8 refs.)

Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector ....See Entry 70745

95.75 TECHNIQUES OF OBSERVATION AND REDUCTION

73998 Photography in the Washington system. D.Geisler, S.Kapranidis (Astron. Dept., Univ. of Washington, Seattle, WA, USA).
Astron. J. (USA), vol.88, no.3, p.461-8 (March 1983).
The Washington photometric system has been established photographically. For a sample of 37 stars in the cluster NGC 6882/5, the mean photographic and photoelectric colors differ by typically 0.02-0.03 m. However, this difference precludes the use of photography to determine accurate abundances for individual stars. The accuracy becomes acceptable when several stars are averaged. Abundances determined from *C-M* are both more precise and in better agreement with photoelectric values than those determined from $M-T_1$. Effective temperature can be determined to within 150-200K of the photoelectric value. Solid-state detectors of sufficient photometric precision will greatly improve the utility of two-dimensional Washington photometry. (11 refs.)

73999 Catalogue of 20457 star positions obtained by photography in the declination zone −48° to −54° (1950). H.Eichhorn (Dept. of Astron., Univ. of Florida, Gainesville, FL, USA), W.D.Googe, C.F.Lukac, J.K.Murphy.
Astron. J. (USA), vol.88, no.4, p.546-58 (April 1983).
The methods for constructing a catalogue of 20457 star positions for the epoch 1964 between −48° and −54° declination are described. The positions were obtained by the overlap method, and images generated by a coarse diffraction grating were employed to control magnitude-related effects on the positions. A selection of about two faint AC stars per square degree was included to serve as material for the eventual determination of magnitude effects on the AC positions. The standard error of a catalogued position estimate based on two images is 0.12″ in either coordinate. (23 refs.)

Images in astronomy ....See Entry 73992

Discovery of DHM0054−284, a quasar of redshift 3.61 ....See Entry 74178

95.80 ASTRONOMICAL OBSERVATIONS (LISTED BY TECHNIQUES OF OBSERVATION)

The central X-ray source in RCW 103: evidence for blackbody emission ....See Entry 74180

95.80D Radio and radar

Radar observations of asteroid 1685 Toro .... See Entry 74033
An upper limit to the microwave continuum radiation from Comet Austin (1982g) .... See Entry 74039
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74052
Range distribution of sporadic meteors and sunrise .... See Entry 74054
Microwave and hard X-ray imaging of a solar flare on 1980 November 5 .... See Entry 74058
Possible supernova in NGC 4258 .... See Entry 74093
Further observations of the long-period binary pulsar PSR 0820+02 .... See Entry 74095
First observations of stellar coronal structure: the coronae of AR Lacertae .... See Entry 74107
Warm H I halos around molecular clouds .... See Entry 74126
Stellar winds and molecular clouds: T Tauri stars .... See Entry 74127
The structure of bright-rimmed molecular clouds .... See Entry 74129
The M17 SW molecular cloud .... See Entry 74131
Sensitive mapping of E and S0 galaxies in search of H I content differences between supernovae and nonsupernovae producing galaxies .... See Entry 74148
Neutral hydrogen in isolated galaxies. II. The large angular diameter galaxies .... See Entry 74149
21-cm observations of galaxies in groups and multiplets .... See Entry 74154
Optical polarization position angle versus radio structure axis in Seyfert galaxies .... See Entry 74158
21 centimeter observations of supercluster galaxies: the bridge between Coma and A1367 .... See Entry 74164
CO observations of the galaxies in the Leo triplet: NGC 3623, NGC 3267, and NGC 3628 .... See Entry 74165
Observations of low redshift H I in Stephan's Quitent .... See Entry 74166
Rotation measures for compact variable radio sources .... See Entry 74168

95.80G Far infrared (bolometric, photoconductive)

The NH_3 spectrum in Saturn's 5 micron window .... See Entry 74034
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74050
Infrared light curves of Type I supernovae. II. Late stages .... See Entry 74090
PSR 1937+214 .... See Entry 74098
IR maps of M17 in the [O III] 88 micron and 52 micron lines and [N III] 57 micron line measurements .... See Entry 74125
Intensity and extinction irregularities in the H_2 emission from Orion .... See Entry 74133
Detection of interstellar NH_3 in the far-infrared: warm and dense gas in Orion-KL .... See Entry 74135
Blue compact dwarf galaxies. II. Near-infrared studies and stellar populations .... See Entry 74145

95.80J Photographic region (near infrared, visible, and normal ultraviolet)

An atlas of H II regions in 125 galaxies .... See Entry 74000
Optical investigations of the Moon and spectrophotometric standards .... See Entry 74002
A CCD imager search for possible material orbiting Saturn between 10 and 36 Saturnian radii .... See Entry 74036
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74043
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74044
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74046
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74047
Comet Sugano-Saigusa-Fujikawa (1983e) .... See Entry 74048
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74049
Comet Sugano-Saigusa-Fujikawa (1983e) .... See Entry 74051
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74052
Comet Sugano-Saigusa-Fujikawa (1983e) .... See Entry 74053
HH 1 and HH 2: the results of an eruptive event in the Cohen-Schwartz star? .... See Entry 74067
The r- and s-process nuclei in the early history of the Galaxy: HD 122563 .... See Entry 74068
A search for weak Hα emission line pre-main-sequence stars .... See Entry 74069
Nova shells .... See Entry 74070
Orbital periods of novae before eruption .... See Entry 74071
An Hα survey of southern hemisphere active chromosphere stars .... See Entry 74075
Time-resolved spectrophotometry of the emission lines in the galactic X-ray source H 2252−035 .... See Entry 74076
HR 9070: a nonradially pulsating Be star? .... See Entry 74080
High-resolution Hα observations of γ Cas and π Aqr .... See Entry 74081
CD−30°5135 .... See Entry 74083
Nova muscae 1983 .... See Entry 74084
Six variable stars discovered in binary systems .... See Entry 74085
Observations of four variable stars in binary systems .... See Entry 74086
Variable star in Orion .... See Entry 74087
Possible supernova in NGC 4258 .... See Entry 74093
Supernovae .... See Entry 74094
Detection of flare like events and their relationship to presumed spot regions on V471 Tau: a solar-stellar connection .... See Entry 74106
HR 7578: a K dwarf double-lined spectroscopy binary with peculiar abundances .... See Entry 74108
The short-period eclipsing system XY UMa: 1982 *UBV* light curves and a flare-like event .... See Entry 74110
A *UBV* photoelectric investigation of the eclipsing binary system DM Virginis .... See Entry 74111
Astrometric studies of ten double or suspected multiple systems from plates taken with the Sproul 61-cm refractor .... See Entry 74112
Photoelectric minima times of the eclipsing binary V508 Ophiuchi .... See Entry 74114
Epochs of minimum light for several eclipsing binaries .... See Entry 74115
UBVRI photometric standard stars around the celestial equator .... See Entry 74118
NGC 6067 and three Cepheids .... See Entry 74120
Search for new variable stars in NGC 5927, 5946, and 6144 .... See Entry 74121
The Cyanogen inhomogeneity of NGC 362 .... See Entry 74122
Distribution of forbidden neutral carbon emission in the Ring Nebula (NGC 6720) .... See Entry 74123
Interstellar Hα emission along the galactic equator .... See Entry 74124
MSH 15−52: a supernova remnant containing two compact X-ray sources .... See Entry 74128
A study of Hα velocities in NGC 1499, NGC 7000, and IC 1318B/C .... See Entry 74130
The surface brightness of reflection nebulae: NGC 1432 and the 17 Tauri nebulosity .... See Entry 74132
Magellanic Cloud planetary nebula with suspected strong forbidden iron lines .... See Entry 74136
The distribution of ionized gas in the nuclei of spiral galaxies .... See Entry 74143
NGC 1275: a burgeoning elliptical galaxy .... See Entry 74146
X-ray and optical studies of emission-line Markarian galaxies .... See Entry 74147
A color-magnitude diagram for Leo II .... See Entry 74150
Redshifts for 115 galaxies near the equator .... See Entry 74152
On the evolution of the spiral galaxies in the Virgo cluster .... See Entry 74153
Photometry of Cepheids in the LMC and Magellanic Cloud abundances .... See Entry 74155
NGC 4151 .... See Entry 74156
Optical polarization position angle versus radio structure axis in Seyfert galaxies .... See Entry 74158
CCD photometry of Abell clusters. II. Surface photometry of 249 cluster galaxies .... See Entry 74159
Reddening indicators for quasars and Seyfert 1 galaxies .... See Entry 74170
Optical and X-ray observations of faint quasars in an optically selected sample .... See Entry 74173
Spectroscopy of variable blue stellar objects .... See Entry 74175
Discovery of DHM0054−284, a quasar of redshift 3.61 .... See Entry 74178
Distribution of QSOs around NGC 1097 .... See Entry 74179

95.80M Space ultraviolet

Comet IRAS-Araki-Alcock (1983d) .... See Entry 74047
Comet IRAS-Araki-Alcock (1983d) .... See Entry 74050
The role of spicules in heating the solar atmosphere: implications of EUV observations .... See Entry 74059
Episodic mass loss and narrow lines in gamma Cassiopeiae and in other early-type stars .... See Entry 74072
Chromospheric emission of W Ursae Majoris-type stars and its relation to the structure of their common envelopes .... See Entry 74105
First observations of stellar coronal structure: the coronae of AR Lacertae .... See Entry 74107
The partial phase of the eclipse of epsilon Aurigae .... See Entry 74113
High-velocity iron absorption lines in supernova remnant 1006 .... See Entry 74134
Reddening indicators for quasars and Seyfert 1 galaxies .... See Entry 74170
Spectroscopy of variable blue stellar objects .... See Entry 74175
Solrad 11 observations of the far-ultraviolet background .... See Entry 74183

95.80N X-ray

Microwave and hard X-ray imaging of a solar flare on 1980 November 5 .... See Entry 74058
The period history of the X-ray pulsar in MSH 15−52 .... See Entry 74096
X-ray properties of the Be/X-ray system 2S 0114+650=LSI+65°010 .... See Entry 74103
Orbital period changes in Centaurus X-3 .... See Entry 74104
Detection of flare like events and their relationship to presumed spot regions on V471 Tau: a solar-stellar connection .... See Entry 74106
First observations of stellar coronal structure: the coronae of AR Lacertae .... See Entry 74107
X-ray burst observations of Serpens X-1 .... See Entry 74109
MSH 15−52: a supernova remnant containing two compact X-ray sources .... See Entry 74128
X-ray and optical studies of emission-line Markarian galaxies .... See Entry 74147
Optical and X-ray observations of faint quasars in an optically selected sample .... See Entry 74173
Einstein observations of the rho Ophiuchi dark cloud. An X-ray Christmas tree .... See Entry 74182
The soft X-ray diffuse background .... See Entry 74184

95.85 CATALOGUES, ATLASES ETC

74000 **An atlas of H II regions in 125 galaxies.** P.W.Hodge (Astron. Dept., Univ. of Washington, Seattle, WA, USA), R.C.Kennicutt,Jr..
Astron. J. (USA), vol.88, no.3, p.296-328 (March 1983).
Data on the positions of 10632 H II regions in 125 galaxies are presented in the form of Hα photographs, numbered charts, and tables of off-set positions. Complete data are printed for ten examples, NGC 1232, NGC 2403, NGC 3031, NGC 4254, NGC 4303, NGC 4321, NGC 4535, NGC 4631, NGC 6946, and IC 342, while the data for the remaining galaxies are available

from the American Institute of Physics' Physics Auxiliary Publication Service. (9 refs.)

74001 The Asiago Catalogue of Quasi Stellar Objects. C.Barbieri, M.Capaccioli, S.Cristiani, G.Nardon, A.Omizzolo (Istituto di Astron., Univ. di Padova, Padova, Italy).
Mem. Soc. Astron. Ital. (Italy), vol.53, no.3, p.511-23 (1982). In Italian.
A catalogue containing QSOs known from literature published before December 31, 1981, has been compiled at the Asiago Observatory. Basic data (names, equatorial and galactic coordinates, photometry, redshifts, information on radio emission, variability, morphology, presence of absorption lines, X-ray emission and finding charts), individual notes and further details concerning absorption spectra as well as X-ray properties are provided for 2004 QSOs. Cross-reference tables are also supplied in order to make easier the correct identification of the objects. (8 refs.)

Catalogue of 20457 star positions obtained by photography in the declination zone −48° to −54° (1950) .... See Entry 73999

96.00 SOLAR SYSTEM

96.20 MOON

74002 Optical investigations of the Moon and spectrophotometric standards. L.A.Akimov, E.P.Gol'dberg, S.Z.Omarov, N.V.Opanasenko, V.A.Psarev, Yu.G.Shkuratov (Kharkov Astron. Obs., A.M. Gor'kii State Univ., USSR).
Sol. Syst. Res. (USA), vol.16, no.3, p.121-6 (July-Sept. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.3, p.153-8 (July-Sept. 1982). [received: April 1983]
Data on the spectral and phase variations of the brightness factor for two small lunar areas (the centers of the craters Plato and Le Monnier) are given (no worse than 5% accuracy). It is proposed to use these as standard data in those astrophysical investigations where spectrophotometric tie-ins to the Moon are convenient. (25 refs.)

74003 Problem of the global asymmetry of the lunar sphere. M.Yu.Shevchenko (P.K. Shternberg State Astron. Inst., USSR).
Sol. Syst. Res. (USA), vol.16, no.3, p.127-32 (July-Sept. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.3, p.159-65 (July-Sept. 1982). [received: April 1983]
The statistical distribution over the surface of the Moon of various optical and morphological parameters is investigated separately for the western and eastern hemispheres. The obtained results indicate that, along with the well-known asymmetries of the nearside and farside hemispheres, there is a noticeable west-east asymmetry of the lunar sphere in all these parameters. (16 refs.)

96.30 PLANETS AND SATELLITES

(exc. the Moon; for celestial mechanics, see 95.10; for Earth as an astronomical body, see 91. Geophysics)

74004 Report of the IAU Working Group on Cartographic Coordinates and Rotational Elements of the Planets and Satellites: 1982. M.E.Davies (Rand Corp., Santa Monica, CA, USA), V.K.Abalakin, J.H.Lieske, P.K.Seidelmann, A.T.Sinclair, A.M.Sinzi, B.A.Smith, Y.S.Tjuflin.
Celestial Mech. (Netherlands), vol.29, no.4, p.309-21 (April 1983).
Discusses the report of the IAU Working Group on Cartographic Coordinates and Rotational Elements of the Planets and Satellites as presented at the XVIII General Assembly held at Patras, Greece, 1982. Tables give the recommended values for the direction of the north poles of rotation and the prime meridians of the planets and satellites referred to both the B1950 and J2000 standard coordinate systems. Reference surfaces for mapping these bodies are described. An appendix discusses the principal changes to the tables since 1979. (7 refs.)

74005 About the non-existence of additional analytical integral in the problem of a satellite's motion under the gravitational attraction of a triaxial rigid body. A.H.Borham (Dept. of Theoretical Mech., Moscow State Univ., Moscow, USSR).
Celestial Mech. (Netherlands), vol.29, no.4, p.323-8 (April 1983).
Poincare's (1971) method is developed to prove the non-existence of additional analytical integral in the degeneration case. (3 refs.)

74006 Thick shell tectonics on one-plate planets: applications to Mars. W.B.Banerdt (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), R.J.Phillips, N.H.Sleep, R.S.Saunders.
J. Geophys. Res. (USA), vol.87, no.B12, p.9723-33 (30 Nov. 1982). [received: May 1983]
A theory for stress distributions in thick lithospheric shells on one-plate planets is developed based on the zero frequency equations of a self-gravitating elastic spherical shell overlying a strengthless fluid. Stress distributions in lithospheres are reviewed for both the compensated and flexural modes. In the former case, surface stresses only depend on surface topography, while for the latter case, it is shown for long wavelengths that stress trajectories are mainly dependent on the lithospheric lateral density distribution and not on elastic properties. Computational analyses are carried out for Mars, and it is found that isostatically compensated models correctly predict the graben structure in the immediate Tharsis region and a flexural loading model is satisfactory in explaining the graben in the regions surrounding Tharsis. A three-stage model is hypothesized for the evolution of Tharsis: isostasy with north-south graben formation on Tharsis, followed by flexural loading and radial graben formation on the perimeter of Tharsis, followed by a last stage of loading with little or no regional deformation. (37 refs.)

Impossibility of the capture of retrograde satellites in the restricted three-body problem .... See Entry 73980

96.30E Venus

74007 Mechanisms for lithospheric heat transport on Venus: implications for tectonic style and volcanism. S.C.Solomon (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA), J.W.Head.
J. Geophys. Res. (USA), vol.87, no.B11, p.9236-46 (10 Nov. 1982). [received: May 1983]
The tectonic and volcanic characteristics of the surface of Venus are poorly known, but these characteristics must be closely related to the mechanism by which Venus rids itself of internal heat. On the other solid planets and satellites of the solar system, lithospheric heat transport is dominated by one of three mechanisms: (1) plate recycling, (2) lithospheric conduction, and (3) hot spot volcanism. The authors evaluate each mechanism as a candidate for the dominant mode of lithospheric heat transfer on Venus, and explores the implications of each mechanism for the interpretation of Venus surface features. Despite claims made to the contrary in the literature, plate recycling on Venus cannot be excluded the basis of either theoretical arguments or present observations on topography and radar backscatter. Landforms resulting from plate convergence and divergence on Venus would differ substantially from those on the Earth because of the high surface temperature and the absence of oceans on Venus, the lack of free or hydrated water in subducted material, the possibility that subduction would more commonly be accompanied by lithospheric delamination, and the rapid spreading rates that would be required if plate recycling removes a significant fraction of the internal heat. The strongest conclusion to emerge from this evaluation is that most of the major topographic features and probably many of the surface geological units on Venus are young by comparison with the surfaces of the smaller terrestrial planets. (99 refs.)

74008 Panoramas of the Venera-13 and Venera-14 landing sites (a preliminary analysis). K.P.Florenskii, A.T.Bazilevskii, A.S.Selivanov (V.I. Vernadskii Inst. of Geochem. & Analytical Chem., Acad. of Sci., USSR).
Sol. Syst. Res. (USA), vol.16, no.3, p.97-107 (July-Sept. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.3, p.131-8 (July-Sept. 1982). [received: April 1983]
Analysis of the panoramas has shown that rocks with a thin horizontal layering have developed at the Venera-13 and Venera-14 landing sites. The characteristic morphological features of these rocks are similar to those for rocks found at the Venera-9 and Venera-10 landing sites, and they offer grounds for assuming a volcanic-sedimentary nature of these formations. The age of the rocks is unknown. (14 refs.)

74009 Investigation of Venus with Venera-13 and -14 probes: first data on composition of rocks. Yu.A.Surkov, O.P.Shcheglov, L.P.Moskaleva, V.P.Kharyukova, O.S.Manvelyan, V.S.Kirichenko, A.D.Dudin (V.I. Vernadskii Inst. of Geochem. & Analytic Chem., USSR).
Sol. Syst. Res. (USA), vol.16, no.3, p.107-21 (July-Sept. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.3, p.139-52 (July-Sept. 1982). [received: April 1983]
Elements composing the rocks on Venus have been determined. The determination of the composition of the rocks was carried out in the areas where the Venera-13 and -14 probes landed. The samples of rocks for analysis were selected with the help of a special soil-sampling device and analysed by X radiometry. The analysis of rocks was done in the most typical of the regions of Venus: a hilly upland (Venera 13) and a smooth lowland (Venera 14). The composition of the rocks in the area of Venera 13s landing turned out to be similar to the potash-alkali basalts, and the composition of the rocks in the area of Venera 14s landing was similar to the tholeitic basalts of the Earth's crust. A comparison of the composition of typical rocks of Venus with that of rocks of analogous structural-morphological areas of the Earth indicates several differences in the formation of the surface and crust of these planets. (14 refs.)

96.30G Mars

74010 Gravity field model of Mars in spherical harmonics up to degree and order eighteen. G.Balmino (Bureau Gravimetrique Internat., Toulouse, France), B.Moynot, N.Vales.
J. Geophys. Res. (USA), vol.87, no.B12, p.9735-46 (30 Nov. 1982). [received: May 1983]
A new model of Mars gravity field in spherical harmonics up to eighteenth degree and order is computed from all available Doppler tracking data of Mariner 9 and Viking 1 and 2 orbiters. It represents an achievement in the knowledge of Mars global gravitational potential, since no more data will be available for such a derivation before the next mission to the planet. The model is extensively tested from the point of view of orbit representation over periods of time ranging from a few hours to 12 days, and it is currently used for geophysical studies of the Martian lithosphere. (6 refs.)

74011 New radar-derived topography for the northern hemisphere of Mars. G.S.Downs (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), P.J.Mouginis-Mark, S.H.Zisk, T.W.Thompson.
J. Geophys. Res. (USA), vol.87, no.B12, p.9747-54 (30 Nov. 1982). [received: May 1983]
Earth-based radar altimetry data for the northern equatorial belt of Mars (6°S-23°N) have recently been reduced to a common basis corresponding to the 6.1-mbar reference surface. A first look at these data indicates that the elevations of Tharsis, Elysium, and Lunae Planum are lower (by 2-5 km) than has been suggested by previous estimates. These differences show that the required amount of tectonic uplift (or constructional volcanism) for each area is less than has been previously envisioned. Atmospheric or surficial conditions are suggested which may explain the discrepancies between the radar topography and elevations measured by other techniques. The topographies of Chryse Planitia, Syrtis Major, and Valles Marineris are also described. (30 refs.)

74012 Evolution of the Tharsis province of Mars: the importance of heterogeneous lithospheric thickness and volcanic construction. S.C.Solomon (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA), J.W.Head.
J. Geophys. Res. (USA), vol.87, no.B12, p.9755-74 (30 Nov. 1982). [received: May 1983]
The traditional explanation of the Tharsis province is that uplift of the lithosphere caused by a thermal, chemical, or dynamical anomaly in the Martian mantle or crust led to lithospheric fracturing and to the later volcanic emplacement of thin plains units and large shields. By this explanation the majority of the topographic anomaly is due to uplift. The authors propose a new mode for the origin and evolution of the Tharsis province which emphasizes that the topography of Tharsis may be produced largely by construction, rather than uplift. The model is based on the premise that the elastic lithosphere of Mars was laterally heterogeneous early in Martian history. Stress due to both global and local causes was concentrated in zones of thin lithosphere. As a result, fracturing was also concentrated in such zones and favored localization of volcanism by providing access to the surface for mantle-derived magma. The heating associated with volcanism maintained the lithosphere locally thin, so that further fracturing and volcanism were concentrated in the same area. The Tharsis rise was thus built primarily by volcanic construction. Most visible tectonic features, by this model, were produced by the response of the lithosphere to loading, not by uplift. (109 refs.)

74013 Tectonic history of the Tharsis region, Mars. J.B.Plescia (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), R.S.Saunders.
J. Geophys. Res. (USA), vol.87; no.B12, p.9775-91 (30 Nov. 1982). [received: May 1983]
The faults of the Tharsis region of Mars have been mapped and delineated on the basis of age. The orientation of each group of faults was analyzed to determine if they were radial to a point. The results indicate that there are at least four discrete centers of faulting within the Tharsis area which are of significantly different age. The four centers proposed are, from oldest to youngest, (1) in the Thaumasia highlands, (2) in northern Syria Planum, and finally, (3) and (4) near Pavonis Mons, While episodes 3 and 4 occupy the same geographic position, they are separated in time by the development of the Tharsis lava plains and shields. Each episode of tectonism was separated from the next by a period of major basaltic volcanism. (40 refs.)

74014 The role in lithospheric stress in the support of the Tharsis rise. R.J.Willemann, D.L.Turcotte (Dept. of Geological Sci., Cornell Univ., Ithaca, NY, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9793-801 (30 Nov. 1982). [received: May 1983]
The Tharsis rise on Mars is a broad topographic high covered by volcanic plains and capped by large volcanoes. The geoid high associated with Tharsis shows that shallow isostatic compensation is not complete. The authors hypothesize that the Tharsis rise can be approximated as an axisymmetrical igneous construct. Linear theory for the deflection of planetary lithospheres is used to show that the lithospheric stresses required partially to support the construct are reasonable and consistent with the observed radial grabens around Tharsis. The computed thickness of the elastic lithosphere is between 110 and 260 km depending on the assumed values for crustal thickness and crustal density. The computed thickness of the Tharsis load is between 40 and 70 km. The contribution of Tharsis to the gravitational flattening of Mars is computed. The tectonics of the Tharsis region are briefly reviewed. (20 refs.)

74015 The structure and evolution of ancient impact basins on Mars. P.H.Schultz (Lunar & Planetary Inst., Houston, TX, USA), R.A.Schultz.
J. Geophys. Res. (USA), vol.87, no.B12, p.9803-20 (30 Nov. 1982). [received: May 1983]
The number of Martian impact basins, once thought deficient owing to a low number of impactors, has been significantly increased through the identification of structural imprints that remains even after nearly complete erasure of basin massifs. Five ancient multiringed impact basins are selected for detailed study and exhibit a systematic pattern of rejuvenation of the multiring plan through endogenic modification. Concentric zones of unstable terrain are believed to reflect deep-seated, impact-related fractures that have localized regional igneous processes in a manner analogous with the basin-controlled distribution of basalts on the Moon. Most Martian outflow channels are found to originate along the unstable ring zones. Hydrothermal melting and temporary confinement of channel source materials at sites analogous to lunar sinuous rille source regions are proposed to play an important role in the distribution of Nartian outflow channels. Ancient basins also can be delineated by the concentric pattern of topographically and structurally controlled narrow valley networks that are particularly abundant along the outer rings where basin ejecta deposits occur. The systematic patterns of valley networks, stable and unstable annuli, scarps, and massifs provide bases for interpreting impact structure in general and for recognizing multiringed structures elsewhere. (32 refs.)

74016 Martian volcanic materials: preliminary thickness estimates in the eastern Tharsis region. R.A.De Hon (Dept. of Geosci., Northeast Louisiana Univ., Monroe, LA, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9821-8 (30 Nov. 1982). [received: May 1983]
Mars displays a variety of volcanic materials from high standing constructs to smooth plains. These materials are evaluated in terms of their susceptibility to thickness determination, and a representative area is analyzed. The Martian ridged plains are much like lunar maria in both surface expression and apparent mode of emplacement. Flooded craters within the ridged plains materials provide an estimate of the thickness distribution. In the Tharsis region, ridged plains materials occur as part of the layered sequence on the east flank of the Tharsis dome. Partially buried craters indicate that the ridged plains materials ranged from zero meters thick at their eastern limit to over 1.5 km thick westward on the flank of the dome where they are overlain by younger materials. These materials are responsible for only a small portion of the total relief of the Tharsis dome. (19 refs.)

74017 Tharsis volcanoes: separation distances, relative ages, sizes, morphologies, and depths of burial. J.L.Whitford-Stark (Geology Dept., Sul Ross State Univ., Alpine, TX, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9829-38 (30 Nov. 1982). [received: May 1983]
Network analysis indicates the separation distances of the Tharsis volcanoes to be 700 to 900 km; this is considered to be the thickness of the Tharsis thermal lithosphere or 'tectosphere' which has thickened with time. Although as a whole the Tharsis volcanoes exhibit a random distribution, preferential alignments emerge when the history of the region is divided into separate periods. The preferential alignments mimic those of fractures in the surrounding terrain. Photogeologic and morphometric data indicate that the volcanoes fall into four distinct classes: montes, tholi, paterae, and a class whose sole representative is Alba Patera. The volcanoes have been buried by lava up to about 4 km in thickness. The sizes of the volcanoes directly correlate with their separation distance from their nearest neighbors. (34 refs.)

74018 Volcanoes and volcanic provinces: Martian western hemisphere. D.H.Scott (US Geological Survey, Flagstaff, AZ, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9839-51 (30 Nov. 1982). [received: May 1983]
The recognition of some Martian landforms as volcanoes is based on their morphology and geologic setting. Other structures, however, may exhibit classic identifying features to a varying or a less degree: these may be only considered provisionally as having a volcanic origin. Regional geologic mapping of the western hemisphere of Mars from Viking images has revealed many more probable volcanoes and volcanotectonic features than were recognized on Mariner 9 pictures. These abundant volcanoes have been assigned to several distinct provinces on the basis of their areal distribution. Although the Olympus-Tharsis region remains as the principal center of volcanism on Mars, four other important provinces are now also recognized: the lowland plains, Tempe Terra plateau, southern highlands (in the Phaethontis and Thaumasia quadrangles), and a probable ignimbrite province, situated along the highland-lowland boundary in Amazonis Planitia. (32 refs.)

74019 Syrtis Major: a low-relief volcanic shield. G.G.Schaber (US Geological Survey, Flagstaff, AZ, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9852-66 (30 Nov. 1982). [received: May 1983]
Viking orbiter images and earth-based radar elevation data are used to document the volcanic geology of Syrtis Major and to reevaluate its physiographic setting. These data indicate that Syrtis Major is actually a very low relief, simple shield with a central caldera complex; arcuate segments of concentric grabens at the shield summit define the limits of a 280-km-diameter depression that is thought to have been created by foundering of a magma chamber. Lava flows with well-defined scarps are associated with two summit calderas; fissures and lava tubes are recognized on the shield flanks. Compressional stresses acting on the shield were apparently greatest following the deposition of the ridged-plains unit but continued at a somewhat reduced rate after deposition of the younger lavas. The extremely low-relief shield of the Syrtis Major as well as other volcanic plains of intermediate age in the eastern hemisphere of Mars is in striking contrast to the giant shields of Tharsis Montes. (34 refs.)

74020 Subkilometer Martian volcanoes: properties and possible terrestrial analogs. H.Frey, M.Jarosewich (Geophys. Branch, NASA Goddard Space Flight Center, Greenbelt, MD, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9867-79 (30 Nov. 1982). [received: May 1983]
Kilometer to subkilometer cones with large central craters are the most numerous volcanic structures in the northern plains of Mars. Based on examination of more than 12000 high resolution Viking orbiter images, most of these very small cones are located in parts of Eastern Acidalia and Utopia-Isidis-Elysium Planitia. Measurements of base and pit diameter for some 2000 well-resolved features show small variations in the histogram of base diameters between and within regions but remarkable similarity in the distribution of crater/cone diameter ratios. This suggests that the small cones had a similar origin with only minor variations in local conditions. The Acidalia cones are generally larger, more widely distributed, and occur on a greater variety of terrains than those in Utopia-Isidis-Elysium. Based on morphology, distribution, and the crater/cone ratio histograms the smallest Martian cones may be similar to Icelandic pseudocraters. (16 refs.)

74021 Absence of silicic volcanism on Mars: implications for crustal composition and volatile abundance. P.W.Francis (Lunar & Planetary Inst., Houston, TX, USA), C.A.Wood.
J. Geophys. Res. (USA), vol.87, no.B12, p.9881-9 (30 Nov. 1982). [received: May 1983]
The authors believe that much of the evidence presented for large scale explosive volcanism on Mars is not convincing, and in particular that interpretation of various rock units on Mars as silicic ignimbrites is speculative and unfounded. The authors summarize the characteristics of terrestrial explosive volcanism, the resulting landforms, and the tectonic and petrologic conditions leading to their formation. With this background, the authors then discuss photogeologic evidence for some postulated examples of Martian explosive and/or silicic volcanism, examine the relevant petrological and tectonic conditions prevailing on Mars, and speculate on the significance of the apparent absence of silicic volcanism on the planet. (49 refs.)

74022 Explosive volcanism on Hecates Tholus, Mars: investigation of eruption conditions. P.J.Mouginis-Mark (Dept. of Geological Sci., Brown Univ., Providence, RI, USA), L.Wilson, J.W.Head,III..
J. Geophys. Res. (USA), vol.87, no.B12, p.9890-904 (30 Nov. 1982). [received: May 1983]
Evidence is presented supporting the identification of a discrete, well-preserved air fall deposit generated by explosive volcanism on Mars. The deposit is located immediately to the west of the summit caldera of Hecates Tholus (32°N, 209°W), the northernmost of the three volcanic constructs in the Elysium Planitia region. The absence of superposed impact craters larger than the resolution limit of the Viking images indicates a very young age for this eruption, which evidently postdates even the most recent collapse episode of the Olympus Mons caldera (~300 MY BP; Neukum and Hiller (1981)). From the distribution of craters smaller than 2 km in diameter, it appears that the air fall material mantles an area about 50×75 km in extent to an estimated thickness of about 100 m. By adapting numerical models for terrestrial volcanic eruptions to the Martian environment, these dimensions imply an eruption cloud height of about 70 km. In order to attain such an altitude, the mass eruption rate must have been $\sim 10^7$ kg/s and the volatile content either ~1 wt.% for H_2O or ~2 wt.% for CO_2. (63 refs.)

74023 Mars: stratigraphy and gravimetry of Olympus Mons and its aureole. K.H.Hiller (Inst. fur Allgemeine und Angewandte Geologie, Ludwig-Maximilants-Univ., Munchen, Germany).
J. Geophys. Res. (USA), vol.87, no.B12, p.9905-15 (30 Nov. 1982). [received: May 1983]
Olympus Mons and its surroundings are investigated using impact crater statistics. Crater retention ages of all major geological units show that their emplacement occurred during three time intervals which are discussed. The regional stratigraphy is discussed as part of the global geological history. The question of the genesis of the aureole material is addressed by gravity models. The topographic mass of Olympus Mons contributes about 80% to the aureole gravity high northwest of the mountain. The gravity high of the entire aureole can be explained by a density model consisting of the topographic masses of Olympus Mons and the aureole materials. (20 refs.)

74024 Further evidence for a mass movement origin of the Olympus Mons aureole. R.Lopes, J.E.Guest (Univ. of London Obs., London, England), K.Hiller, G.Neukum.
J. Geophys. Res. (USA), vol.87, no.B12, p.9917-28 (30 Nov. 1982). [received: May 1983]
Analysis of the ridge, graben, and fracture patterns on the aureole material surrounding Olympus Mons lends further support to an origin by gravity sliding of the outer flanks of the shield. The patterns provide evidence of the nature of sliding, especially in the last stages of emplacement. No part of the slide need have traveled the whole extent of the aureole. For the slides to occur on a shallow slope, reduction of shear strength of the materials involved is required, possibly by melting of ground ice. Triggering mechanisms could be volcanically related Marsquakes and possibly stresses induced on the surrounding area by the growing Olumpus Mons volcano. (18 refs.)

74025 Relict drainages, conical hills, and the eolian veneer in southwest Egypt—applications to Mars. C.S.Breed, J.F.McCauley, M.J.Grolier (US Geological Survey, Flagstaff, AZ, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9929-50 (30 Nov. 1982). [received: May 1983]
Viking images indicate that no single process is sufficient to explain the origin and evolution of Martian landforms. Landforms common to both Earth and Mars result from a complex interplay of geologic agents, including water, mass wasting, wind, and possibly ice. The relict wadis of the Gilf Kebir Plateau in southwest Egypt strongly resemble fluvial channels on Mars, parti-

cularly those of the fretted terrain. The unusual geomorphic characteristics of the Gilf region are herein interpreted as the results of an extreme eolian and mass-wasting overprint on a landscape originally carved by running water. The fluvial and mass wasting origin of the particles in the eolian deposits, the segregation of these materials according to grain size, and the migration of those particles capable of saltation to areas of accumulation in lowland basins of the Sahara are suggested as analogs for the formation and accumulation of 'sand' sheets and dunes on the northern plains and in the polar erg on Mars. (88 refs.)

74026 Ice sculpture in the Martian outflow channels. B.K.Lucchitta (US Geological Survey, Flagstaff, AZ, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9951-73 (30 Nov. 1982). [received: May 1983]
Many landforms in Martian outflow channels have characteristics that suggest sculpture by glaciers, ice streams, or ice sheets. Viking Orbiter and terrestrial satellite images are examined at similar resolution to compare features of the Martian outflow channels to features produced by the movement of ice on Earth. Many resemblances were found. They include the anastromoses, sinuosites, and U-shaped cross profiles of valleys; hanging valleys; and linear scour marks on valley walls, grooves and ridges on valley floors, and streamlining of bedrock highs. The question of whether ice could have moved in the Martian environment is investigated. Since gradients on Martian channel floors are extremly low or even reversed, a certain thickness of ice is requried to initiate glacial motion. If ice filled the Martian channels to the level of interior plateaus, flow could have occurred, even under present climatic conditions, although warmer climates in the past would have been more favorable. Additionally, if the channel fluids were brines, ice might have been wet based and would have moved readily by slipping over the ground. (59 refs.)

74027 A model of Martian slope winds: implications for Eolian transport. J.Magalhaes, P.Gierasch (Center for Radiophys. & Space Res., Cornell Univ., Ithaca, NY, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9975-84 (30 Nov. 1982). [received: May 1983]
Observations of dark Martian wind streaks not associated with visible topographic points of origin ('coalesced dark streaks') show these features to favor regions with slopes of 1°-10°. To investigate the circulation over such slopes, the authors adopt a Boussinesq fluid and assume a constant eddy diffusivity parameterization for small-scale mixing. The equations of motions are scaled to determine the range of slopes over which a strong local circulation due to slope winds can exist. A simple one-dimensional analytic model is solved to determine friction velocities and velocity and temperature profiles. For reasonable choices of the input parameters, the authors find friction velocities and wind velocities suggestive of active downslope eolian transport on slopes of 1°-10°. (24 refs.)

74028 Martian dust mantling and surface composition: interpretation of thermophysical properties. P.R.Christensen (Dept. of Earth & Space Sci., Univ. of California, Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9985-98 (30 Nov. 1982). [received: May 1983]
The surface block abundance, fine component thermal inertia, thermal emissivity, and relative atmospheric dust content are determined for selected regions on Mars, using broadband infrared spectral properties measured at 7, 9, 11, and 20 m by the Viking infrared thermal mapper (IRTM). Each of the surface and atmospheric properties produce characteristic spectral signatures which are successfully modeled. The surface is modeled by a mixture of a high-inertia 'block' component and a fine component, with wavelength dependent emissivity. The ubiquity of nonaeolian materials exposed on the surface suggests that there has not been substantial net deposition within this region. However, some dust deposition may be occurring in low-inertia regions. Observed global variations in the fine component inertia may be due to changes in the degree of bonding of the surficial material. During the relatively clear period studied, the atmospheric opacity was found to vary spatially. (40 refs.)

74029 Present wind activity on Mars: relation to large latitudinally zoned sediment deposits. P.Thomas (Lab. for Planetary Studies, Cornell Univ., Ithaca, NY, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.9999-10008 (30 Nov. 1982). [received: May 1983]
The relation of present Martian winds to large latitudinally zoned sediment deposits is investigated using global wind streak data and mapping of large sand and dust deposits. Dune sand deposits occur primarily in three latitude belts: north polar (74°-85°N), low latitude (5°N-20°S), and south polar (40°-80°S). Comparison with wind streak data shows the high-latitude dunes to be in areas of seasonally reversing winds. The present winds can form latitudinal dune belts from a variety of initial dune distributions, including uniform distribution and a polar source. The presence of dune sand within the polar layered deposits, the erosional state of the deposits, and the present surface wind flow away from the poles indicate that both polar dune concentrations have been derived from erosion of the layered deposits. (46 refs.)

74030 Rate of wind abrasion on Mars. R.Greeley (Dept. of Geology, Arizona State Univ., Tempe, AZ, USA), R.N.Leach, S.H.Williams, B.R.White, J.B.Pollack, D.H.Krinsley, J.R.Marshall.
J. Geophys. Res. (USA), vol.87, no.B12, p.100009-24 (30 Nov. 1982). [received: May 1983]
Estimation of the rate of aeolian abrasion of rocks on Mars requires knowledge of (1) particle flux (2) susceptibilities to abrasion of various rocks, and (3) wind frequencies on Mars. Fluxes and susceptibilities for a wide range of conditions were obtained in the laboratory and combined with wind data from the Viking meteorology experiment. Assuming an abundant supply of sand-sized particles, estimated rates range up to 2.1×10^{-2} cm of abrasion per year in the vicinity of Viking Lander 1. This rate is orders of magnitude too great to be in agreement with the inferred age of the surface based on models of impact crater flux. The discrepancy in the estimated rate of abrasion and the presumed old age of the surface cannot be explained easily by changes in climate or exhumation of ancient surfaces. The authors consider the primary reason to be related to the agents of abrasion. Either windblown grains are in very short supply, or the grains are ineffective as agents of abrasion. (46 refs.)

74031 Wind streaks in Tharsis and Elysium: implications for sediment transport by slope winds. S.W.Lee, P.C.Thomas, J.Veverka (Lab. for Planetary Studies, Cornell Univ., Ithaca, NY, USA).
J. Geophys. Res. (USA), vol.87, no.B12, p.10025-41 (30 Nov. 1982). [received: May 1983]
Detailed maps of wind streaks in Tharsis and Elysium have been compiled from Viking Orbiter observations spanning one complete Martian year. The streak pattern is controlled by slope winds on the central volcanoes and on the flanks of the Tharsis bulge, while the global circulation dominates in Elysium. Dust erosion by downslope wind occurs over much of Tharsis and in the vicinity of Elysium Mons: this process is effective even at the low atmospheric pressures found near the summits of the large volcanoes. Erosional streaks are largely absent in Elysium Planitia; net deposition of dust might have occurred during the period of our observations. Surface properties such as slope, thermal inertia, and roughness may influence the efficiency of slope wind production sufficiently to account for the pronounced differences in streak types and patterns present in these two regions. (40 refs.)

74032 Results of a study of the gravitational field, figure, and internal structure of Mars. G.A.Meshcheryakov, A.L.Tserklevich (Leninsky Komsomol Polytech. Inst., Lvov, Ukrainian SSR).
Sol. Syst. Res. (USA), vol.16, no.3, p.133-9 (July-Sept. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.3, p.166-73 (July-Sept. 1982). [received: April 1983]
Gives consideration to some questions which arise in comparing models of the gravitational field. To address these questions, the authors determine the parameters of the figure, study their regional peculiarities, and investigate the isostatic condition and the density distribution inside the planet. (25 refs.)

Thick shell tectonics on one-plate planets: applications to Mars ....See Entry 74006

96.30H Asteroids

74033 Radar observations of asteroid 1685 Toro. S.J.Ostro (Dept. of Astron., Cornell Univ., Ithaca, NY, USA), D.B.Campbell, I.I.Shapiro.
Astron. J. (USA), vol.88, no.4, p.565-76 (April 1983).
Reports results of 13-cm-wavelength radar observations of 1685 Toro conducted in July 1980 at the Arecibo Observatory. The data yield detections of radar echoes in the same sense of circular polarizations as transmitted (i.e. the SC sense) as well as in the opposite (OC) sense. The radar spectra reveal correlated, approximately twofold variations in radar cross section and spectral bandwidth as functions of rotational phase, with two maxima and two minima per rotation cycle. The estimate of the ratio of SC to OC echo power, $\mu_c=0.18\pm0.04$, suggests that most, but certainly not all, of the backscattering is due to single reflections from surface elements that are fairly smooth at decimeter scales. However, the total absence of the sharply peaked spectral signature of quasi-specular scattering requires substantial roughness at some much larger scale(s). When combined with photopolarimetric results of Dunlap et al. (1973), the observations provide constraints on Toro's size, shape, and surface properties. The maximum distance of any part of Toro's surface from the spin axis is between 2.4 and 3.4 km. The ratio of Toro's longest to shortest equatorial widths is between 1.4 and 2.2. Modeling Toro as a homogeneous scattering ellipsoid yields weighted-least-squares estimates for the lengths of the equatorial semiaxes: $a=2.60\pm0.10$ km and $b=1.68\pm0.17$ km, and a nearly Lambertian scattering law. The magnitude of the post-fit residuals suggests systematic departures of Toro from this simplified model, including a possible surface feature with enhanced radar reflectivity and depolarization. (33 refs.)

96.30K Jupiter

Physics of the Jovian magnetosphere ....See Entry 69806

96.30M Saturn

74034 The NH_3 spectrum in Saturn's 5 micron window. U.Fink, H.P.Larson, G.L.Bjoraker, J.R.Johnson (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.880-8 (15 May 1983).
Spectra of Saturn's 5 μm window were obtained at the Infrared Telescope Facility on Mauna Kea, Hawaii. The spectra have a resolution of 1.2 cm^{-1}, and some exhibit extremely low amounts of $\sim$300 μm ppt telluric H_2O. The Saturn spectra show absorptions by the $2\nu_2$ band of NH_3. Long-path laboratory comparison spectra of NH_3 were acquired and show considerable deviations in intensity from theoretical predictions. The calibration of Saturn's observed NH_3 features with the laboratory data gives 2.0 ± 0.5 m-amagat of NH_3 using the $2\nu_2$ Q-branch at 5.32 μm. The $R(1)$ and $R(2)$ lines yield an abundance about 3 times greater. Absorptions outside the range of the Q-branch can be accounted for by solid NH_3 of 10-20 μm equivalent path length. The origin of Saturn's 5 μm flux is mostly thermal with some admixture of solar reflected radiation. A depletion of Saturn's NH_3 abundance below the solar value is indicated, but confirmation of this conclusion will require a better understanding of the atmospheric penetration depth at 5 μm and more rigorous modeling of the spectral line formation. (28 refs.)

74035 Occultations by possible rings in Saturn's outer magnetosphere: 1982-1985. D.J.Mink (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA).
Astron. J. (USA), vol.88, no.4, p.559-61 (April 1983).
Analysis of Pioneer and Voyager low-energy plasma ion data has suggested the presence of particulate rings in Saturn's outer magnetosphere. Fourteen occultations of stars by these possible rings between August 1982 and December 1985 are presented. Three of these stars are also occulted by Saturn and its known rings. (2 refs.)

74036 A CCD imager search for possible material orbiting Saturn between 10 and 36 Saturnian radii. R.L.Baron (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA), J.L.Elliot.
Astron. J. (USA), vol.88, no.4, p.562-4 (April 1983).
Optical imaging of the area west of Saturn from 10 to 36 Saturnian radii was used to search for possible orbiting material to a limit of $I=+22$ arcsec^{-2} for material distributed over a region larger than the seeing disk of ≈3 arcsec. For sources smaller than the seeing disk, a limit of $I=+19.5$ was reached. (6 refs.)

96.30T Other planets

74037 On the global distribution of Pluto's atmosphere. L.Trafton (Astron. Dept., Univ. of Texas, Austin, TX, USA), S.A.Stern.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.872-81 (15 April 1983).
Pluto's volatile atmosphere currently extends essentially uniformly around the globe and has nearly uniform thickness, discounting topographic elevation differences and tidal effects. Although in equilibrium with the surface ice, the atmosphere does not noticeably freeze out on the night side, during eclipses of the Sun by Charon, or at the poles during Pluto's present season near perihelion. The rotational and tidal deformations of the atmosphere affect the atmospheric thickness by 0.6-2% for a pure CH_4 atmosphere, depending on the unknown mass of Charon, and up to 15% for an atmosphere with high mean molecular weight. An important consequence of the global uniformity of Pluto's atmosphere and the observed CH_4 column abundance of 27 ± 7

m−Am is that Pluto's surface is close to 58K over the entire globe. This compares with the value ~43K expected on the basis of insolation and black-body radiation. The authors discuss the explanation for Pluto's elevated surface temperature. (21 refs.)

96.50 OTHER OBJECTS IN THE PLANETARY SYSTEM

96.50G Comets

74038 Charge exchange in solar wind-cometary interactions. T.I.Gombosi, M.Horanyi, K.Kecskemety (Central Res. Inst. for Phys., Hungarian Acad. of Sci., Budapest, Hungary), T.E.Cravens, A.F.Nagy.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.889-98 (15 May 1983).
The effects of charge exchange between fast solar wind ions and slow cometary neutrals at the contact discontinuity separating the ionosphere of a comet from the solar wind flow are examined. The continuity equations were solved analytically for a water-dominated cometary ionosphere, including both ionization and recombination processes. It was found that this new solution differs significantly from the one obtained by neglecting recombination. The normalized neutral and ion densities in the atmospheres of active comets were shown, using an appropriate dimensionless variable to exhibit an interesting scaling behavior. Solar wind ions have a significant probability of participating in a charge exchange interaction with a cometary neutral molecule, because the cometary neutral particle density beyond the contact discontinuity is not negligible. Charge exchange can effectively increase the distance of the contact discontinuity from the nucleus by removing a significant portion of the momentum from the solar wind flow. For instance, it is shown that for realistic Comet Halley parameters charge exchange can possibly increase the standoff distance from a couple of hundred to a few thousand kilometers. (18 refs.)

74039 An upper limit to the microwave continuum radiation from Comet Austin (1982g). L.E.Snyder (Dept. of Astron., Univ. of Illinois, Urbana, IL, USA), P.Palmer, C.M.Wade.
Astrophys. J. Lett. Ed. (USA), vol.269, no.1, pt.2, p.L21-3 (1 June 1983).
A sensitive search for continuum radiation at 6.1 cm wavelength from Comet Austin (1982g) was made with the VLA at the time of its closest approach, in 1982 August. No signal was detected; the best upper limit for the daily continuum flux density is 1.4×10^{-4} Jy. This is nearly an order of magnitude less than the flux density predicted on the basis of the icy grain halo model. (9 refs.)

74040 New Comet Sugano-Saigusa-Fujikawa 1983e. S.W.Milbourn.
Br. Astron. Assoc. Circ. (GB), no.635, 1 pp. (18 May 1983).
It is reported that a 7th-magnitude comet was discovered in Andromeda on 1983 May 8. Preliminary parabolic orbital elements are given, together with an ephemeris for the period 1983 May 16 to June 5 at five-day intervals, for the period 1983 June 5 to 20 at one-day intervals, and for the period 1983 June 20 to 30 at five-day intervals. The comet is expected to be at a minimum distance of 0.063 AU from the Earth on 1983 June 13, when it will be at magnitude 4.0. (no refs.)

74041 Comet IRAS-Araki-Alcock 1983d. S.W.Milbourn.
Br. Astron. Assoc. Circ. (GB), no.635, 1 pp. (18 May 1983).
Improved parabolic orbital elements are presented, together with an ephemeris for the period 1983 May 21 to June 30, at five-day intervals. (no refs.)

74042 Attitude perturbations of the Giotto spacecraft in the dust cloud of comet Halley. G.M.Coupe, R.M.Dean (Spacecraft Technol., Dept., ESA Tech. Directorate, Noordwijk, Netherlands), R.Laine.
ESA J. (Netherlands), vol.7, no.1, p.15-24 (1983).
ESA's interplanetary spacecraft Giotto will fly-by comet Halley in March 1986 on a trajectory that will bring the spacecraft within a few hundred kilometres of the comet nucleus. It is intended that it should pass through the scientifically interesting, relatively dense part of the dust cloud surrounding the nucleus, which will inevitably disturb the spacecraft's attitude. It will be spinning at a nominal 15 rpm and is equipped with a two-element dust protection shield to protect its vital equipment from damage due to dust-particle impacts occurring at a relative velocity of about 69 km/s. Taking into account the latest updates of the comet dust and gas environment model, this paper presents a mathematical evaluation of the statistical properties of the spacecraft attitude perturbations to be expected during Giotto's entry into and traversal through the comet dust cloud. (7 refs.)

74043 Comet IRAS-Araki-Alcock (1983d). J.Davies, J.Gibson, C.S.Morris, J.-C.Merlin, J.Bortle, D.Green, E.Everhart, E.Schwart, G.Schwartz, D.P.Cruikshank, R.Brown, M.Geffert.
I.A.U. Circ. (USA), no.3798, 1 pp. (6 May 1983).
It is reported that Comet IRAS-Araki-Alcock was detected on 1983 April 26 by the IRAS Preliminary Analysis Facility. Exposures on 1983 May 2 show the trailed images of the comet to have a strongly condensed nucleus and a weak asymmetric coma, denser on the northeastern side; there was no evidence of a tail. Visual magnitude estimates and coma diameters are reported for the period 1983 May 4 to 6; 14 precise positions covering the same period are also reported. (1 ref.)

74044 Comet IRAS-Araki-Alcock (1983d). V.Smith, B.G.Marsden.
I.A.U. Circ. (USA), no.3799, 1 pp. (6 May 1983).
It is reported that visual observations of the comet on 1983 May 5 showed no real structure but a stellar nucleus. Digicon-scanner spectra showed the nucleus to be dominated by reflected sunlight; some faint C emission at 516 nm was detected from a very faint extension 5″ to the northeast. Improved parabolic orbital elements are presented, together with an ephemeris; this ephemeris covers the period 1983 May 8.0 to 10.0 at 0.5-day intervals, and the period 1983 May 10.0 to 11.6 at 0.1-day intervals. (no refs.)

74045 Comet IRAS-Araki-Alcock (1983d). B.G.Marsden.
I.A.U. Circ. (USA), no.3800, 1 pp. (6 May 1983).
Presents a continuation to the ephemeris on IAUC 3799. This ephemeris covers the period 1983 May 11.6 to 13.5 at 0.1-day intervals; the period 1983 May 13.5 to 16.0 at 0.5-day intervals; the period 1983 May 16.0 to 21.0 at one-day intervals; and the period 1983 May 21.0 to June 15.0 at five-day intervals. (1 ref.)

74046 Comet IRAS-Araki-Alcock (1983d). K.Ishida, E.Everhart, R.Weymann, G.Schwartz, C.Kowal, M.Geffert, B.Milet, G.Bothum, J.Drummond.
I.A.U. Circ. (USA), no.3801, 1 pp. (9 May 1983).
The authors report 22 precise positions covering the period 1983 May 2 to 9. In addition the following predicted radiant is given for any meteor shower that may be associated with the comet: maximum on 1983 May 10.1 UT, $\alpha=289°$, $\delta=+44°$. (1 ref.)

74047 Comet IRAS-Araki-Alcock (1983d). B.G.Marsden, M.A'Hearn, R.Millis, M.Festou, P.Benvenuti, C.Cacciari, A.Cassatella, A.Talavera, W.Wamsteker, D.W.E.Green, A.Hale.
I.A.U. Circ. (USA), no.3802, 1 pp. (9 May 1983).
Improved parabolic orbital elements are reported for Comet IRAS-Araki-Alcock. It is reported that a crude reduction of observations on 1983 May 7 yield an OH production rate of 9×10^{27}/sec and a CN production rate of 5×10^{25}/sec. IUE observations of the comet on 1983 May 6 and 8 are also reported. Low resolution spectra (120 to 320 nm) showed emission features due to Lα, S, CS, the CO_2^+ doublet and OH; the continuum was very weak. The CS emission was very strong; the exceptional CS brightness observed within the IUE slit is due to the small geocentric distance and the sharply peaked CS density distribution. From the appearance of the spectrum of the comet in comparison with earlier IUE observations it seems that the comet is not new in the Oort sense. Finally, total naked-eye magnitude estimates and coma diameters are reported for the period 1983 May 7 to 9. (2 refs.)

74048 Comet Sugano-Saigusa-Fujikawa (1983e). Y.Kozai, B.Mayer.
I.A.U. Circ. (USA), no.3803, 1 pp. (9 May 1983).
It is reported that a 7th-magnitude comet has been discovered in Andromeda. Four approximate positions are given for the period 1983 May 8 to 9. (no refs.)

74049 Comet IRAS-Araki-Alcock (1983d). T.Kumanori, G.Douglass, B.Milet, P.Stattmayer, B.Manning, B.A.Skiff, J.Fabricius, R.McNaught, A.C.Gilmore, P.M.Kilmartin.
I.A.U. Circ. (USA), no.3808, 1 pp. (13 May 1983).
Reports a semi-accurate position for the epoch 1983 April 20, and 22 precise positions for the period 1983 May 6 to 12. The April 20 position was obtained from a prediscovery observation. (1 ref.)

74050 Comet IRAS-Araki-Alcock (1983d). D.P.Cruikshank, R.H.Brown, D.Griep, P.D.Feldman, M.F.A'Hearn.
I.A.U. Circ. (USA), no.3809, 1 pp. (13 May 1983).
The authors report infrared observations of Comet IRAS-Araki-Alcock for the period 1983 May 6 to 8, and IUE observations during the period May 11 to 13. Infrared photometric data in nine filter bands from L through Q (3.3 to 20 μm) fit a blackbody curve for about 300K, with no evidence of a silicate emission feature. In addition spectrophotometric scans of the nuclear condensation from 0.8 to 2.6 μm showed no emission features at 5% resolution, but the thermal component of the energy distribution was apparent longward of about 2.4 μm. Spatial scans at 11.6 and 20 μm give a halfpower width of 6″ for the nuclear condensation. The authors also report the discovery from IUE observations of a series of emission bands (attributed to S_2) between 280 and 310 nm; this emission is confined to a region with a diameter no larger than 100 km (5″) around the nucleus of the comet.

74051 Comet Sugano-Saigusa-Fujikawa (1983e). M.Sugano, B.A.Skiff, K.Ishida, T.Seki, R.E.McCrosky, D.W.E.Green, E.Everhart, T.Urata, B.G.Marsden.
I.A.U. Circ. (USA), no.3810, 1 pp. (13 May 1983).
An approximate position is reported for the epoch 1983 May 8, together with six precise positions for 1983 May 10 and 12. Two sets of parabolic orbital elements are presented, with an ephemeris for the period 1983 May 6 to June 5, at five-day intervals. It is predicted that the comet will pass 0.06 AU from the Earth on 1983 June 12, and will then be at 4th or 5th magnitude. (no refs.)

74052 Comet IRAS-Araki-Alcock (1983d). S.M.Larson, D.Campbell, P.Ford, A.Forni, J.Harmon, A.Hine, B.G.Marsden, I.I.Shapiro, P.M.Millman, A.F.Cook, S.Clifton, J.E.Bortle, C.S.Morris.
I.A.U. Circ. (USA), no.3811, 1 pp. (18 May 1983).
It is reported that direct visual inspection at up to 1000x of the comet's nuclear condensation on 1983 May 11 showed a 0.5″±0.1″ disc that, unlike nearby stellar images, appeared to have a sharp edge and uniform brightness. This 12-km feature was presumably not the nucleus since there was no indication of phase. The nuclear condensation was estimated to be of mag. 10.5, implying an albedo of 0.0085. Direct images of the inner coma on May 11 show a sunward-directed fan indicative of a slowly rotating nucleus. Spectra in the range 300 to 560 nm obtained on May 6, 7 and 11 show emission lines of OH, NH, CN, C_2, C_3, NH_2, CO^+, CO_2^+ and probably S_2. Continuous wave radar observations at 2380 MHz on May 11 yielded good strong returns with a 4-Hz bandwidth and a suggestion of a weaker and wider 'skirt'. Preliminary analysis of meteor radio data for the period 1983 May 8 to 11, and photographic and visual monitoring on May 10, show no evidence of unusual meteor activity. Finally visual estimates of the total magnitude and coma diameter of the comet are presented for the period 1983 May 10 to 13. (5 refs.)

74053 Comet Sugano-Saigusa-Fujikawa (1983e). S.J.Bus, E.H.Bus, R.E.McCrosky, D.W.E.Green, B.G.Marsden.
I.A.U. Circ. (USA), no.3812, 1 pp. (18 May 1983).
Four precise positions are reported for the period 1983 May 11 to 18. A visual observation on 1983 May 18 yielded a visual magnitude of $m_1=7.7$ and a tail length of about 15′. Improved parabolic orbital elements are given, together with an ephemeris for the period 1983 May 21 to June 5 at five-day intervals, and for the period 1983 June 5 to 19 at one-day intervals; the comet will approach to within 0.063 AU of the Earth on June 13. (no refs.)

Fluorescence excitation of CO in comets .... See Entry 70848
Rendezvous with Halley's Comet .... See Entry 73966

96.50K Meteors, showers and meteoroids

74054 Range distribution of sporadic meteors and sunrise. G.Cevolani (Lab. FISBAT, Nat. Res. Council, Bologna, Italy), V.Porubcan.
Nuovo Cimento C (Italy), vol.5C, ser.1, no.5, p.561-70 (Sept.-Oct. 1982). [received: May 1983]
The echo ranges of 6921 sporadic meteors, determined by the Budrio meteor radar in April-September 1978 during a 15 hour interval around sunrise, are analysed. The variation of the mean ranges exhibits no correlation with the geomagnetic K_p index. The observed seasonal variation of the mean ranges at three times of the day is accounted for by the position of the Earth's apex. The mean ranges with respect to local sunrise in the meteor region show a variation with a minimum just after sunrise. (11 refs.)

74055 Distribution of particle sizes which are formed in the process of modeling the ablation of meteoric material. V.N.Zelenin, I.E.Konstantinov, S.G.Mikheenko, O.N.Salimov (Inst. of Engng. Phys., Moscow, USSR).
Sol. Syst. Res. (USA), vol.16, no.3, p.140-7 (July-Sept. 1982). Translation of: *Astron. Vestn. (USSR)*, vol.16, no.3, p.174-81 (July-Sept. 1982). [received: April 1983]
Performs experiments to model the destruction of a meteoric body as it moves through the atmosphere. In the experiments, the authors determine the size spectra of particles which are formed in processes such as evaporation-

condensation, atomization of liquid melt, and destruction as a result of the thermal stresses which are set up in the conditions of modeling. The samples used for model meteors were made of iron, basalt, and ceramic. The size distribution of the particles which are formed in the fragmentation process can be approximated by a logarithmic-normal distribution law with parameters which can be related to the parameters of destruction probability. In order to calculate the critical size in the case that destruction is occurring as a result of thermal stresses and atomization of liquid melt by an inflowing stream, the authors obtain theoretical formulas which agree well with the results of the experiments. (14 refs.)

Comet IRAS-Araki-Alcock (1983d) ....See Entry 74046

Comet IRAS-Araki-Alcock (1983d) ....See Entry 74052

96.50M Meteorites, micrometeorites

74056 The formation and the evolution process of the Jilin meteorite. Ouyang Zi-yuan (Inst. of Geochem., Acad. Sinica, Shanghai, China).
Chin. Phys. (USA), vol.3, no.1, p.69-78 (Jan.-March 1983). [received: May 1983]
Based on the data from an integrated study by a multidisciplinary group on the Jilin meteorite, the authors discuss the following aspects concerning its formation and evolution: (1) The fractionation-condensation of the solar nebula was examined based on the condensation and solidification age and the mineral composition of the Jilin meteorite. (2) The thermometamorphic history of the Jilin parent body was discussed based on the data on the loss of rare gases, the chemical composition of the whole rock, the self-purification of rare-earth elements and the composition stability of olivine and orthopyroxene. (3) The cooling process of the Jilin parent body was analyzed according to the Ni content and the width of taenite, and the retentivity of argon and fission tracks in the minerals. (4) The breakup of the Jilin parent body and its cosmic ray irradiation history; based on the measurements of the cosmogenic nuclides as He^3, $Ne^{20,21,22}$, Ar^{38}, Na^{22}, Al^{26}, Mn^{54}, Mn^{53}, Co^{60} etc., a two-stage model of the irradiation history of the Jilin meteorite was proposed. From the data on the Jilin meteorite parent body of the first stage (the age =10-11 MY and r=10 m) and that of the second stage (the age=0.3-0.5 MY and r=80-90 cm). The relative positions of samples in the parent body, their burial depths as well as the post-atmospheric loss by ignition were determined. (5) The falling process of the Jilin meteorite; the orbits of the Jilin meteor in the Solar System and in the atmosphere, and its falling process were discussed. (21 refs.)

74057 ^{39}Ar recoil losses and presolar ages in Allende inclusions. I.M.Villa, J.C.Huneke, G.J.Wasserburg (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.63, no.1, p.1-12 (April 1983).
Ar analyses are reported for five coarse-grained, Ca-Al-rich inclusions from the Allende meteorite. The samples were neutron-irradiated in individual evacuated ampoules, and the Ar gas in the ampoules as well as the samples was analyzed. A large fraction (up to 60%) of the ^{39}Ar from ^{39}K (n, p) reactions was lost out of the inclusions into the ampoules. The ^{39}Ar losses resulted in substantial increases in the apparent ^{40}Ar-^{39}Ar ages of the samples. ^{39}Ar recoil loss during neutron-irradiation is a major effect and must be accounted for in ^{40}Ar-^{39}Ar dating. All of the Allende inclusions studied contained substantial trapped ^{36}Ar. The origin of the trapped ^{36}Ar is unknown, and the possible presence of trapped ^{40}Ar cannot be excluded. Ar measurements on Allende inclusions which have yielded anomalously old ages must be re-examined in the context of ^{39}Ar recoil loss and possible contributions of trapped ^{40}Ar. Allende inclusions appear on both accounts to be poor candidates to search for relicts of presolar materials with well-defined K/Ar ages. (26 refs.)

Barium from a mini *r*-process in supernovae ....See Entry 74091

96.60 SOLAR PHYSICS

74058 Microwave and hard X-ray imaging of a solar flare on 1980 November 5. P.Hoyng (Space Res. Lab., Astron. Inst., Utrecht, Netherlands), K.A.Marsh, H.Zirin, B.R.Dennis.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.865-79 (15 May 1983).
An analysis is given of the flare of 1980 November 5 at 22:26 UT on the basis of radio imaging data from the Very Large Array (VLA) at 15 GHz, X-ray imaging data from the hard X-ray imaging spectrometer (HXIS) in the range 3.5-30 keV, radio and X-ray spectral data, and optical data. The flare produced two impulsive hard X-ray spikes detectable up to 300 keV. VLA images showed compact sources ($\sim 3''$) with brightness temperatures up to 10^9K located over the neutral line. The polarization is opposite on either side of the neutral line, reaching values of 50%-80%. HXIS observed small excess photon fluxes above 16 keV on either side of the VLA microwave source. The microwave and X-ray data imply a magnetic field of about 550 gauss and a bending of the field lines over $\geq 80°$ over a distance of $3''$. Optical, microwave, and X-ray data exclude a common origin of microwaves and hard X-rays from a purely thermal plasma, but they are not inconsistent with a thick-target model: freely streaming fast electrons with energies between 15 keV and >100 keV precipitating along a single magnetic loop with a temperature of $(2.5\text{-}3) \times 10^7$K. (16 refs.)

74059 The role of spicules in heating the solar atmosphere: implications of EUV observations. G.L.Withbroe (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.825-36 (15 April 1983).
Measurements of the spatial and temporal variations of EUV emission from spectral lines formed at temperatures between 2×10^4 and 2×10^6K are used to demonstrate that EUV emitting inhomogeneities, which are associated with spicules disappear at heights ~15000 km above the limb the same height at which Hα spicules disappear. The mean scale height of EUV spicules observed in several quiet regions and a polar coronal hole is 2000 km±300 km, in good agreement with the scale height of Hα spicules. An upper limit is determined for the mass of cool ($T < 5 \times 10^5$K) material at heights $h > 17000$ km. The EUV observations suggest that release of gravitational potential energy of downward flowing cool material from spicules is not the primary source of global heating for the upper chromosphere, although it does make a nonnegligible contribution. If spicular material plays an important role in the global chromospheric-coronal energy balance, it most likely does so by being heated to coronal temperatures at low heights ($h \lesssim 15000$ km). (20 refs.)

74060 Solar type II radio emission and the shock drift acceleration of electrons. G.D.Holman (Astron. Program, Univ. of Maryland, College Park, MD, USA), M.E.Pesses.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.837-43 (15 April 1983).
Many of the properties of energetic electrons and ions accelerated by interplanetary shock waves can be understood in terms of the shock drift acceleration mechanism. The authors show that the shock drift acceleration of electrons can be responsible for solar type II radio bursts as well and review the shock drift acceleration mechanism and show that the streaming distribution of reflected electrons produced upstream of the shock front by this mechanism can be unstable to the generation of electrostatic plasma waves, which in turn interact to produce the observed radio emission. The authors derive constraints upon the density and energy of suprathermal electrons required to produce a typical type II burst. (32 refs.)

74061 Temporal variations of nucleonic abundances in solar flare energetic particle events. I. Well-connected events. G.M.Mason, G.Gloeckler (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA), D.Hovestadt.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.844-62 (15 April 1983).
Surveys the temporal variations of the relative abundances of 0.6-2.4 MeV per nucleon ions accelerated in solar particle events whose parent flares were located in the so-called well-connected region between W20° and W80° solar longitude. The survey was carried out under solar minimum conditions from 1973 November to 1977 December. Several particle events were found which originated in the well-connected region and, of these, two events appeared remarkably free of contamination from other solar particle events or interplanetary disturbances. During the rise phase, the abundances measured at 1 AU were characterized by large decreases in the Fe/O ratios, of the type reported by others, as well as significant decreases in the O/He ratio. It is concluded that the rise phase variations may be understood in terms of interplanetary propagation effects. A detailed comparison of model calculations with the rise phase observations is discussed. (60 refs.)

74062 A thermal model of sunspot influence on solar luminosity. P.Foukal, L.A.Fowler, M.Livshits (Atmospheric & Environmental Res. Inc., Cambridge, MA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.863-71 (15 April 1983).
Recent measurements of the solar irradiance have confirmed that sunspots block energy flow to the photosphere in rough proportion to their area and photometric contrast. The authors construct a time-dependent two-dimensional model of heat flow blocking in a turbulent convective layer to investigate the physical interpretation of the observed irradiance dips. The numerical model shows how formation of a spot at or below the photosphere leads to heating of surrounding convective layers over a diffusive time scale $\tau_D \sim 10^4$ s. This heating rapidly propagates outward, storing the blocked heat throughout the convection zone. The stored thermal (and potential) energy is only released very slowly by radiation through a gradually increasing photospheric temperature. The authors point out that this very efficent storage implies a sunspot contribution to the modulation of $L_\odot$ over the 11 year cycle, at a level somewhat below 0.1%. (43 refs.)

74063 A solar breeder to explain constant luminosity and the lack of neutrinos. C.Alexander, A.M.Perry (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), L.H.Levine, L.M.Libby.
AIP Conf. Proc. (USA), no.96, p.273-6 (1982). (Workshop on Science Underground, Los Alamos, CA, USA, 1982).
A breeder supplying energy in the Sun runs for billions of years. Instead of solar neutrinos, it produces antineutrinos from fission products and actinide decays. It gives the Sun constant luminosity as required by archaean biology. This follows because reactors are negatively thermostatted. (4 refs.)

74064 Spectral line parameters for the pure rotation bands of solar OH. A.Goldman, J.R.Gillis (Dept. of Phys., Univ. of Denver, Denver, CO, USA), J.A.Coxon.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.29, no.5, p.469-70 (May 1983).
Spectral line parameters for the $\Delta\nu = 0$ rotation transitions of OH observable in the solar photosphere are generated. The line parameters, which include line positions, ground state energies and intensities, are calculated at 6000K for the $X^2\Pi(0\text{-}0)$, (1-1), (2-2), and (3-3) bands. (8 refs.)

Underground neutrino astronomy ....See Entry 73964

Energy dynamics in stressed magnetic fields: the filamentation and flare instabilities ....See Entry 73983

On the first-order smoothing expression for the α-effect in dynamo theory ....See Entry 73984

97.00 STARS

97.10 STELLAR CHARACTERISTICS

74065 Multiscale model equations for turbulent convection and convective overshoot. P.S.Marcus (Dept. of Math., MIT, Cambridge, MA, USA), W.H.Press, S.A.Teukolsky.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.795-821 (15 April 1983).
The Navier-Stokes equations for a compressible fluid with radiative diffusivity and viscosity are analyzed in the inelastic limit (Mach number ≪1), using window-function localized Fourier transforms. This technique allows the spectral dynamics of a turbulent eddy cascade to be studied in wavenumber space, while also modeling the spatial variation of the velocities and other mean quantities such as temperature, density, and opacity. Physical arguments which give the expected relative phase of various quantities are used instead of (e.g.) closure assumptions about higher moments. A set of time-dependent equations is obtained. (32 refs.)

On the stability of close binaries in hierarchical three-body systems ....See Entry 73971

On the double averaged three-body problem ....See Entry 73976

Magnetic fields in astrophysics ....See Entry 73988

Photography in the Washington system ....See Entry 73998

A solar breeder to explain constant luminosity and the lack of neutrinos ....See Entry 74063

The environment of T Tauri stars ....See Entry 74066

HH 1 and HH 2: the results of an eruptive event in the Cohen-Schwartz star? ....See Entry 74067

The *r*- and *s*-process nuclei in the early history of the Galaxy: HD 122563 ....See Entry 74068

A search for weak Hα emission line pre-main-sequence stars . See Entry 74069

Nova shells ....See Entry 74070

Orbital periods of novae before eruption ....See Entry 74071

Episodic mass loss and narrow lines in gamma Cassiopeiae and in other early-type stars ....See Entry 74072

The minimum period and the gap in periods of cataclysmic binaries .... See Entry 74073

The dust around the carbon star IRC+10216 .... See Entry 74074

An Hα survey of southern hemisphere active chromosphere stars .... See Entry 74075

Time-resolved spectrophotometry of the emission lines in the galactic X-ray source H 2252−035 .... See Entry 74076

CNO abundances and the strengths of nova outbursts and hydrogen flashes on accreting white dwarfs .... See Entry 74077

Classification of intrinsic variables. IX. The Cepheid domain ..See Entry 74078

Pseudocepheids. I. R Puppis, HR 4441, HR 4511, and AI CMI .... See Entry 74079

HR 9070: a nonradially pulsating Be star? .... See Entry 74080

High-resolution Hα observations of γ Cas and π Aqr .... See Entry 74081

Variable F-type supergiants far above the galactic plane .... See Entry 74082

CD−30°5135 .... See Entry 74083

Nova muscae 1983 .... See Entry 74084

Six variable stars discovered in binary systems .... See Entry 74085

Observations of four variable stars in binary systems .... See Entry 74086

Variable star in Orion .... See Entry 74087

Photometry of a Si-Ap variable .... See Entry 74088

Infrared light curves of Type I supernovae. II. Late stages ......See Entry 74090

Barium from a mini *r*-process in supernovae .... See Entry 74091

Radioactive models of Type I supernovae .... See Entry 74092

Possible supernova in NGC 4258 .... See Entry 74093

Supernovae .... See Entry 74094

Further observations of the long-period binary pulsar PSR 0820+02 .... See Entry 74095

The period history of the X-ray pulsar in MSH 15−52 .... See Entry 74096

PSR 1937+214 .... See Entry 74098

Nonradial *g*-mode oscillations of warm neutron stars .... See Entry 74099

Neutron diffusion and heat transfer in the crusts of neutron stars .... See Entry 74100

X-ray properties of the Be/X-ray system 2S 0114+650=LSI+65°010 .... See Entry 74103

Orbital period changes in Centaurus X-3 .... See Entry 74104

Chromospheric emission of W Ursae Majoris-type stars and its relation to the structure of their common envelopes .... See Entry 74105

Detection of flare like events and their relationship to presumed spot regions on V471 Tau: a solar-stellar connection .... See Entry 74106

First observations of stellar coronal structure: the coronae of AR Lacertae .... See Entry 74107

HR 7578: a K dwarf double-lined spectroscopy binary with peculiar abundances .... See Entry 74108

X-ray burst observations of Serpens X-1 .... See Entry 74109

The short-period eclipsing system XY UMa: 1982 *UBV* light curves and a flare-like event .... See Entry 74110

A *UBV* photoelectric investigation of the eclipsing binary system DM Virginis .... See Entry 74111

Astrometric studies of ten double or suspected multiple systems from plates taken with the Sproul 61-cm refractor .... See Entry 74112

The partial phase of the eclipse of epsilon Aurigae .... See Entry 74113

Photoelectric minima times of the eclipsing binary V508 Ophiuchi .... See Entry 74114

Epochs of minimum light for several eclipsing binaries .... See Entry 74115

A field guide to the binary stars .... See Entry 74116

Post-Newtonian gravitational radiation of a system of two compact objects in the field theory of gravitation .... See Entry 74117

UBVRI photometric standard stars around the celestial equator .... See Entry 74118

NGC 6067 and three Cepheids .... See Entry 74120

Search for new variable stars in NGC 5927, 5946, and 6144 ..See Entry 74121

The Cyanogen inhomogeneity of NGC 362 .... See Entry 74122

Stellar winds and molecular clouds: T Tauri stars .... See Entry 74127

MSH 15−52: a supernova remnant containing two compact X-ray sources .... See Entry 74128

High-velocity iron absorption lines in supernova remnant 1006 .... See Entry 74134

The densities of charged particles in very dense interstellar clouds .... See Entry 74137

NGC 1275: a burgeoning elliptical galaxy .... See Entry 74146

A color-magnitude diagram for Leo II .... See Entry 74150

Globular cluster orbits and the galactic mass distribution .... See Entry 74151

On the evolution of the spiral galaxies in the Virgo cluster .....See Entry 74153

Photometry of Cepheids in the LMC and Magellanic Cloud abundances .... See Entry 74155

Accretion-driven star formation in central dominant galaxies in X-ray clusters .... See Entry 74162

Spectroscopy of variable blue stellar objects .... See Entry 74175

The central X-ray source in RCW 103: evidence for blackbody emission .... See Entry 74180

Einstein observations of the rho Ophiuchi dark cloud. An X-ray Christmas tree .... See Entry 74182

Solrad 11 observations of the far-ultraviolet background .... See Entry 74183

97.20 NORMAL STARS (BY CLASS): GENERAL OR INDIVIDUAL

74066 The environment of T Tauri stars. R.A.Chevalier (Dept. of Astron., Univ. of Virginia, Charlottesville, VA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.753-65 (15 May 1983).
The environments of T Tauri stars are probably determined by the interaction of a stellar wind with matter which is falling toward a newly formed star. As shown by Ulrich (1976), the steady infall of cool gas with angular momentum toward the star leads to a density distribution with $\rho \propto r^{-1/2}$ inside a radius r_d and $\rho \propto r^{-3/2}$ outside r_d. The radius r_d is determined by the angular momentum of the infalling gas. The expansion of the wind into this medium depends on the parameter $\alpha = \dot{M}_w \nu_w / \dot{M}_{in} \nu_{in}(r_d)$, where $\nu_{in}(r_d)$ is the free-fall velocity at r_d, $\dot{M}_{in}$ is the mass accretion rate ν_w is the wind velocity, and $\dot{M}_w$ is the mass loss rate. For $\alpha < 1$, the wind is trapped within r_d, and for $\alpha > 1$, the wind can expand into the cloud. It is likely that the cloud gas is clumpy and that clumps are present in the wind region. If the clumps have sufficiently high surface densities, they fall toward the star. The interaction of the wind with the clumps can ionize the wind gas. This model is applied to T Tauri. The shocked wind gives the radio emission and nebular emission, and dust within the clumps gives the infrared emission. T Tauri is in a transitory phase in which most of the wind has only recently propagated beyond r_d. (37 refs.)

74067 HH 1 and HH 2: the results of an eruptive event in the Cohen-Schwartz star?. R.Mundt (Steward Obs., Univ. of Arizona, Tucson, AZ, USA), L.Hartmann.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.766-77 (15 May 1983).
Spectroscopic observations of the Cohen-Schwartz star (C-S star) have been carried out at medium (Δλ=2 and 3 Å) and at high spectral resolution (Δλ=0.3 Å) using the Arizona/Smithsonian Multiple Mirror Telescope. This T Tauri star is probably the exciting source of HH 1 and HH 2. The C-S star shows typical characteristics of a weak T Tauri activity, with $W_\lambda(H\alpha) \approx 10$ Å. No blueshifted absorption feature is detectable in the high-resolution Hα line profile (signal-to-noise ratio ≈5). The observations presented here, combined with former photometric and spectroscopic studies of the C-S star, indicate that this object has not been very active for the past 30 years. The relatively weak and narrow Hα emission observed gives no indication that continuous mass loss is occurring on the scale required by several models for the excitation of HH 1 and HH 2, with discrepancies of several orders of magnitude. It is possible that FU Orionis type outbursts (or other long-term variations of the exciting source) can resolve the discrepancy. However, it is concluded that none of the presently proposed models for the powering of the shock emission from Herbig-Haro objects provide very satisfactory interpretations of the observational data. (66 refs.)

74068 The *r*- and *s*-process nuclei in the early history of the Galaxy: HD 122563. C.Sneden, M.Parthasarathy (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.757-78 (15 April 1983).
Spectra in the blue and ultraviolet spectral regions have been obtained for the extremely metal-poor giant star HD 122563. A complete model atmosphere, spectrum synthesis analysis of this star is performed, employing a large number of weak iron-peak species lines and laboratory oscillator strengths. Spectral features of many rare earth elements is detected in the ultraviolet. The large overdeficiency of nearly a factor of 10 for the *s*-process element barium is confirmed and is shown to extend to the other *s*-process elements La, Ce, Pr, Nd, and Sm. The *r*-process elements Eu, Gd, Dy, and possibly Er and Yb are less deficient than the *s*-process elements but do exhibit lower ratios with respect to iron-peak elements than in the Sun. A supplementary differential analysis of HD 122563 with respect to the Sun shows that the heavy-element abundances are not very model-atmosphere dependent. The heavy-element abundances can be understood with nucleosynthesis models in which the progenitors of this star produce mainly *r*-process isotopes. A small contribution of the *s*-process to the creation of the elements Sr, Y, Zr, and possibly Ba is not ruled out, but such traditional *s*-process elements as La, Pr, and Nd appear to have been made in the *r*-process in stellar generations prior to the formation of HD 122563. (101 refs.)

74069 A search for weak Hα emission line pre-main-sequence stars. E.D.Feigelson, G.A.Kriss (Dept. of Phys., MIT, Cambridge, MA, USA).
Astron. J. (USA), vol.88, no.3, p.431-8 (March 1983).
Reports a spectroscopic survey of 177 stars brighter than about 12.5 in R near four dark clouds in an effort to find pre-main sequence (PMS) stars with weak Hα emission. A number of such stars have been found previously in X-ray images of star formation clouds. Six new candidate PMS stars with EW (Hα) between 0.4 and 4.2 Å, in addition to four X-ray discovered stars, are found in the L1551 and L1529 clouds in the Taurus-Auriga complex. The total number of pre-main-sequences stars in these clouds appears to be about two times the number of strong emission line T Tauri stars. (31 refs.)

Episodic mass loss and narrow lines in gamma Cassiopeiae and in other early-type stars .... See Entry 74072

The dust around the carbon star IRC+10216 .... See Entry 74074

An Hα survey of southern hemisphere active chromosphere stars .... See Entry 74075

Time-resolved spectrophotometry of the emission lines in the galactic X-ray source H 2252−035 .... See Entry 74076

CNO abundances and the strengths of nova outbursts and hydrogen flashes on accreting white dwarfs .... See Entry 74077

Pseudocepheids. I. R Puppis, HR 4441, HR 4511, and AI CMI .... See Entry 74079

High-resolution Hα observations of γ Cas and π Aqr .... See Entry 74081

Variable F-type supergiants far above the galactic plane .... See Entry 74082

CD−30°5135 .... See Entry 74083

Variable star in Orion .... See Entry 74087

PSR 1937+214 .... See Entry 74098

X-ray properties of the Be/X-ray system 2S 0114+650=LSI+65°010 .... See Entry 74103

Chromospheric emission of W Ursae Majoris-type stars and its relation to the structure of their common envelopes .... See Entry 74105

Detection of flare like events and their relationship to presumed spot regions on V471 Tau: a solar-stellar connection .... See Entry 74106

HR 7578: a K dwarf double-lined spectroscopy binary with peculiar abundances .... See Entry 74108

The short-period eclipsing system XY UMa: 1982 *UBV* light curves and a flare-like event .... See Entry 74110

A *UBV* photoelectric investigation of the eclipsing binary system DM Virginis .... See Entry 74111

The partial phase of the eclipse of epsilon Aurigae .... See Entry 74113

Photoelectric minima times of the eclipsing binary V508 Ophiuchi .... See Entry 74114

Search for new variable stars in NGC 5927, 5946, and 6144 ..See Entry 74121

The Cyanogen inhomogeneity of NGC 362 .... See Entry 74122

Stellar winds and molecular clouds: T Tauri stars .... See Entry 74127

High-velocity iron absorption lines in supernova remnant 1006 ....See Entry 74134
A color-magnitude diagram for Leo II ....See Entry 74150
Stellar contributions to the hard X-ray galactic ridge ....See Entry 74181

97.30 VARIABLE AND PECULIAR STARS

(inc. novae)

74070 Nova shells. J.G.Cohen, A.J.Rosenthal (Palomar Obs., California Inst. of Technol., Pasadena, CA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.689-97 (15 May 1983).
A search to find spatially resolved nova shells was carried out; two new shells (around FH Ser 1970 and V533 Her 1963) were discovered. The angular sizes measured at the current epoch of the eight previously known shells around novae which erupted prior to 1945 imply that the shells are coasting out at constant velocity. Expansion velocities, interstellar absorptions, and masses of the ejected material were determined for several recent novae. A new calibration of the maximum visual luminosity-rate of decline relationship for galactic novae is given. (32 refs.)

74071 Orbital periods of novae before eruption. B.E.Schaefer (MIT, Center for Space Res., Cambridge, MA, USA), J.Patterson.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.710-17 (15 May 1983).
Uses the collection of archival plates at Harvard College Observatory to search for the eclipse periods of two novae (BT Mon and DQ Her) both before and after the outburst. The eclipse period of BT Mon is manifest in the data both before and after its 1939 eruption. The pre-eruption eclipse period is 0.3338010 d, which is 40 parts per million shorter than the modern period. With reasonable assumptions concerning the angular momentum carried off by the ejected material, this provides a dynamical measure of the mass of the ejecta, which is estimated to be 3×10^{-5} $M_{\odot}$. The specific angular momentum of the shell around BT Mon cannot be greatly in excess of the specific orbital angular momentum of the white dwarf. Analysis of all available data fails to specify the pre-eruption eclipse period of DQ Her, presumably because the light curve is badly smeared by the long photographic exposure times. (35 refs.)

74072 Episodic mass loss and narrow lines in gamma Cassiopeiae and in other early-type stars. H.F.Henrichs, G.Hammerschlag-Hensberge (Astron. Inst., Univ. of Amsterdam, Amsterdam, Netherlands), I.D.Howarth, P.Barr.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.807-24 (15 May 1983).
High-resolution ultraviolet spectra obtained with the IUE of the B0.5 IVe star γ Cas have revealed conspicuous changes in the profiles of the resonance doublet lines of C IV, N V, and Si IV. In 18 out of the 28 available spectra, narrow absorption components (FWHM$\leq$160 km s^{-1}) of varying strengths (up to almost saturated profiles) are found at the blueshifted side of the rest wavelength. Sometimes the components are multiple. The central velocities of the narrow lines are between -650 and $+1500$ km s^{-1}. It is suggested that the occurrence of these narrow, high-velocity, high-excitation absorption lines (usually referred to as 'narrow lines') might be a common phenomenon in all early-type stars, irrespective of luminosity class or Be characteristics. The observations are in agreement with a (phenomenological) model proposed earlier for the occurrence and properties of the narrow lines. It is suggested that these lines are formed in a rapidly expanding region of the stellar wind which has a higher density than the ambient 'quiet' wind, and which has resulted from an enhanced mass flux of the star during a short time (about 1 day). The physical cause of the proposed episodic mass-loss enhancement remains unexplained. (56 refs.)

74073 The minimum period and the gap in periods of cataclysmic binaries. B.Paczynski (Theoretical Astrophys., California Inst. of Technol., Pasadena, CA, USA), R.Sienkiewicz.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.825-31 (15 May 1983).
The 81 minute cutoff to the orbital periods of hydrogen-rich cataclysmic binaries is consistent with evolution of those systems being dominated by angular momentum losses due to gravitational radiation. Unfortunately, many uncertainties, mainly poorly known atmospheric opacities below 2000K, make it practically impossible to verify the quadrupole formula for gravitational radiation by using the observed cutoff at 81 minutes. The upper boundary of the gap in orbital periods observed at about 3 hours is almost certainly due to enhanced angular momentum losses from cataclysmic binaries which have longer periods. The physical mechanism of those losses is not identified, but a possible importance of stellar winds is pointed out. The lower boundary of the gap may be explained with the oldest cataclysmic binaries, whose periods evolved past the minimum at 81 minutes and reached the value of 2 hours within about 12×10^{9} years after the binary had formed. Those binaries should have secondary components of only 0.02 solar masses, and their periods could be used to estimate ages of the oldest cataclysmic stars, and presumably the age of Galaxy. An alternative explanation for the gap requires that binaries should be detached while crossing the gap. A possible mechanism for this phenomenon is discussed. It requires the secondary components to be about 0.2 solar masses in the binaries just below the gap. (22 refs.)

74074 The dust around the carbon star IRC+10216. M.Jura (Dept. of Astron., Univ. of California, Los Angeles, CA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.647-52 (15 April 1983).
IRC+10216 is the brightest 5 μm source in the sky outside the Solar System, and it is an extremely well studied carbon star that is losing mass rapidly. The author argues that it is possible to compare sensibly the far-infrared and ultraviolet extinctions of the circumstellar gains because the same dust that shields molecules such as HCN from photodissociation also emits the observed far infrared emission. The author finds that the dust opacity varies approximately as $\lambda^{-1.3}$ when λ varies by a factor of 10^{3}. This estimate of the infrared to ultraviolet opacities is of central importance in understanding infrared observations of grains. That is, if interstellar carbon grains in general are similar to the ones around IRC+10216, they emit efficiently in the infrared, and one expects them in general to be appreciably cooler than often but not always believed. (42 refs.)

74075 An Hα survey of southern hemisphere active chromosphere stars. B.W.Bopp (Dept., of Phys. & Astron., Univ. of Toledo, Toledo, OH, USA), J.B.Hearnshaw.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.653-4 (15 April 1983).
Obtains moderate resolution Hα spectrograms of 27 southern hemisphere F-K stars with known or suspected Ca II emission, selected from the lists of Hearnshaw (1979), Weiler and Stencel (1979), and Bidelman and MacConnell (1973). The purpose is to search for the presence of Hα emission, which would be characteristic of stars with extreme levels of chromospheric activity. Two objects were found to have Hα emission as strong as V711 Tau. Seven others had a very weak or absent Hα absorption line, either partially or completely filled by chromospheric emission. These nine stars of exception activity should be observed at a variety of resolutions and wavelengths. (10 refs.)

74076 Time-resolved spectrophotometry of the emission lines in the galactic X-ray source H 2252−035. J.T.Clarke, K.O.Mason, S.Bowyer (Space Sci. Lab., Univ. of California, Berkeley, CA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.726-31 (15 April 1983).
Carries out time-resolved optical spectrophotometry of the galactic X-ray source H 2252−035 for the purpose of studying intensity variations in the high-excitation emission lines. At a time resolution of $\sim$2 minutes, the four brightest emission lines (Hα, Hβ, Hγ, and He II λ4684) all showed short time-scale flickering and a pronounced orbital period variation in phase with the continuum modulation. The authors also detect an orbital period variation in the Balmer decrement in which the ratio Hα:Hβ:Hγ is markedly flatter at the time of the continuum maximum. To fit these observations they propose a two-component model for the line emission region in which one component of the lines comes from the accretion disk as a whole and the other from the more highly photoionized bulge region where the accretion column from the companion star intersects the disk. (14 refs.)

74077 CNO abundances and the strengths of nova outbursts and hydrogen flashes on accreting white dwarfs. J.MacDonald (Dept. of Astron., Univ. of Illinois, Urbana, IL, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.732-46 (15 April 1983).
Simple theories of the accretion phase and expansion phase of hydrogen shell flashes on accreting white dwarfs are used to find the conditions under which classical novae occur. Particular attention is paid to the possibility that the CNO abundances in the accreted envelope are greatly enhanced relative to the Sun. It is shown that such an enhancement is necessary for fast novae yet slow novae, can still occur with large CNO enhancements. Analysis of the observed properties of nova ejecta indicates that the white dwarfs in nova systems have masses in the range 1.02-1.18 $M_{\odot}$. It is found that in some novae, the accretion rate deduced from the optical luminosity in quiescence is too high to allow accretion of sufficient envelope material to get the strong hydrogen flash needed for the nova outburst. Some possible resolutions of this problem are discussed. The authors find it unlikely that recurrent novae are thermonuclear runaways on accreting white dwarfs. (89 refs.)

74078 Classification of intrinsic variables. IX. The Cepheid domain. O.J.Eggen (Cerro Tololo Inter-American Obs., La Serena, Chile).
Astron. J. (USA), vol.88, no.3, p.361-78 (March 1983).
For pt.VIII see Astrophys. J. Suppl., vol.41, no.3, p.413-34 (1979). Intermediate band, Hβ and RI observations have been obtained throughout the cycle of variation for 135 high mass, long-period and short-period Cepheids (LPC and SPC). This material, together with the observations previously discussed for some 100 ultrashort period Cepheids (USPC), is used to delineate the Cepheid domain in the (β, [C$_1$]) and (M_{Bol},log T_e) planes. Three new, small amplitude SPC are included as well as the probable, very short-period Cepheid (VSPC) in the old disk population F0 Vir. Observations of early-type stars and the SPC DL Cas in NGC 129 are also presented. The independently derived luminosity calibrations for bright giants and supergiants previously published are found to closely reproduce the luminosities derived from the Sandage-Tammann PL relation for most variables. The majority of the LPC are apparently overabundant in metals, referred to the Sun, although some rare cases of both underabundance and overluminosity may exist. Reddening determinations for the LPC indicate a small systematic correction to previous results. The theoretical 'fundamental blue edge', computed by Iben and Tuggle with Y=0.38, closely represents the blue edge of the Cepheid domain. Photometry of 39 nonvariable bright giants and supergiants in the Bright Star Catalogue places eight of them in the Cepheid domain of the (β, [C_1]) plane. Subsequent observations have indicated light variations in three of these stars. (49 refs.)

74079 Pseudocepheids. I. R Puppis, HR 4441, HR 4511, and AI CMI. O.J.Eggen (Cerro Tololo Inter-American Obs., La Serena, Chile).
Astron. J. (USA), vol.88, no.3, p.386-403 (March, 1983).
Pseudocepheids (PC) are supergiants in the Hertzprung gap with light variations more erratic than those of Cepheids. Light variations, colour indices, reddening, cluster memberships, intrinsic indices and metal abundances are considered for R Puppis, HR 4441, HR 4511 and AI Caris Minoris. (40 refs.)

74080 HR 9070: a nonradially pulsating Be star?. J.R.Percy (David Dunlap Obs., Univ. of Toronto, Toronto, Ontario, Canada).
Astron. J. (USA), vol.88, no.3, p.427-30 (March 1983).
The bright Be star HR 9070 is photometrically variable with a range of about 0.03$^{\mathrm{m}}$ and a period of about 0.307$^{\mathrm{d}}$. The period appears to be stable to better than 1% over many years. The light curve is sinusoidal. There are no significant variations in uvby colors. Of all the possible explanations for the variability, the most likely is nonradial pulsation. (15 refs.)

74081 High-resolution Hα observations of γ Cas and π Aqr. G.Fontaine, P.Lacombe, F.Wesemael (Dept. de Phys., Univ. de Montreal, Montreal, Quebec, Canada).
Astron. J. (USA), vol.88, no.4, p.527-31 (April 1983).
High-resolution (0.28-Å) observations of the Hα emission line in the two Be stars γ Cas and π Aqr are presented. A total of 16 and 19 independent observations, respectively, were obtained for these two stars over a two-day period. In contrast to some previous reports, no changes in equivalent width, radial velocity, and line profile were detected in either star over time scales of several hours. To the authors' knowledge, these upper limits on these variations ($\gtrsim$0.5% for the line profiles; $\gtrsim$8 km s^{-1} for the radial velocity) are the most stringent available to date for these two stars. (11 refs.)

74082 Variable F-type supergiants far above the galactic plane. D.D.Sasselow (Dept. of Astron., Univ. of Sofia, Sofia, Bulgaria).
Inf. Bull. Variable Stars (Hungary), no.2314, p.1-2 (19 April 1983).
The author draws attention to a class of F-type supergiant stars, the members of which exhibit strikingly similar photometric behaviour, galactic distribution and kinematics. These stars are characterised by semi-regular light variations with Δm$\leq$0.6 mag. (usually 0.2 mag.); two or three alternating periods from about 30 to 120 days; spectral type F0-F7 Ia-Ib; $\langle B-V\rangle_0$ from +0.10 to +0.50; $|z|\geq1$ kpc; and space velocities typical of Population II stars. Photometrically these stars are outside the Cepheid instability strip, they occupy a compact isolated area on the P-C diagram, and they do not obey the semiperiod-L-C relation for 'normal' supergiants; it is suggested that they pulsate non-radially. In addition these stars seem to have normal Population I abundances and mild infrared excesses. The best studied members of the class are UU Herculis, 89 Herculis, HD 161796, BL Telescopii (F), and HD 112374. The author also draws attention to compact swarms of F-type supergiants (which may prove to be similar objects) around SA 28, SA 27 and SA 11. (11 refs.)

74083 CD−30°5135. G.Welin (Astron. Obs., Uppsala, Sweden).
Inf. Bull. Variable Stars (Hungary), no.2315, 1 pp. (19 April 1983).
The author reports photographic UBV magnitudes for the peculiar variable emission-line F-type supergiant CD−30 5135, obtained on November 9, December 9 and December 27, 1982. An unusually low value of U−B was recorded on 1982 December 9; it is possible that this anomaly was the result

of rapid light variations between the termination of the U-exposure and the beginning of the B-exposure. (1 ref.)

74084 Nova muscae 1983. F.M.Bateson (Variable Star Section, RASNZ, Tauranga, New Zealand).
Inf. Bull. Variable Stars (Hungary), no.2316, 1 pp. (20 April 1983).
The author reports that he has received two pre-discovery photographs of Nova Muscae 1983, taken on 1983 January 15 between $14^h 20^m$ and $15^h 15^m$ UT. The photographs were taken on Ektachrome 400 film, hypersensitised in 8% hydrogen at 25° for 24 hours. The extreme redness of the nova and the absence of stars with similar colour index made measurement of the magnitude of the nova difficult, but the magnitude is estimated at between 7.6 and 7.9 on both photographs. (1 ref.)

74085 Six variable stars discovered in binary systems. R.L.Walker (US Naval Obs., Flagstaff, AZ, USA).
Inf. Bull. Variable Stars (Hungary), no.2318, 3 pp. (21 April 1983).
The authors reports photoelectric UBV photometry between September 1968 and November 1979 of six variable stars belonging to visual binary systems. The data given are the ADS and BD numbers of the stars, the coordinates for 1900.0, the heliocentric Julian Day of the observation, the V-magnitude and the B-V and U-B colour indices. The stars observed were ADS 11632 B (BD+59°1915), ADS 14233 ABp (BD+11°4368), ADS 14894 AB (BD+2°4346), Kui 110 AB (BD+61°2233), ADS 15679 A (BD+44°4059), and ADS 15794 AB (BD+43°4165). (1 ref.)

74086 Observations of four variable stars in binary systems. R.L.Walker (US Naval Obs., Flagstaff, AZ, USA).
Inf. Bull. Variable Stars (Hungary), no.2319, pp.2 (21 April 1983).
The author reports photoelectric UBV photometry between September 1968 and April 1979 of four variable stars belonging to visual binary systems. The data tabulated are the ADS and BD numbers of the stars, their coordinates for 1900.0, information on the nature of the variable star, the heliocentric Julian Day of the observation, the V-magnitude, and the B-V and U-B colour indices. The stars observed were ADS 2046 A (=BD−1°0377=84 Ceti), ADS 8148 AB (=BD+11°2348=ι Leonis), ADS 11353 ABp (=BD+0° 3936=d Serpentis), and ADS 16483 A (=BD+27°4480=β Pegasi). The first two stars are δ Scuti variables, d Serpentis is an irregularly variable spectroscopic binary (G0 III+A6 V), and β Pegasi is an M-type irregular variable. (no refs.)

74087 Variable star in Orion. G.Klare, I.Appenzeller.
I.A.U. Circ. (USA), no.3809, 1 pp. (13 May 1983).
The authors report that plates taken early in the century with the 0.4-m f/5 Bruce astrograph show that this star was significantly brighter at that time on the Palomar Sky Survey. On 1901 January 16 the star was clearly visible at a measured B=17.5. On 1904 January 10 the star was close to the plate limit at an estimated B 17.5. (1 ref.)

74088 Photometry of a Si-Ap variable. J.A.R.Caldwell, A.W.J.Cousins (South African Astron. Obs., Observatory, S Africa).
Mon. Notes Astron. Soc. South Afr. (S. Africa), vol.41, no.7-10, p.85-90 (Oct. 1982). [received: April 1983]
The multiple star HR 3661 (E4.40) is variable with P=2.91 days. From the spectral type, B8V (pSi), it is thought that one component is a Si-Ap type variable. (13 refs.)

The environment of T Tauri stars .... See Entry 74066

A search for weak Hα emission line pre-main-sequence stars . See Entry 74069

X-ray properties of the Be/X-ray system 2S 0114+650=LSI+65°010 ....See Entry 74103

Detection of flare like events and their relationship to presumed spot regions on V471 Tau: a solar-stellar connection ....See Entry 74106

First observations of stellar coronal structure: the coronae of AR Lacertae ....See Entry 74107

The short-period eclipsing system XY UMa: 1982 *UBV* light curves and a flare-like event ....See Entry 74110

NGC 6067 and three Cepheids ....See Entry 74120

Search for new variable stars in NGC 5927, 5946, and 6144 ..See Entry 74121

Stellar winds and molecular clouds: T Tauri stars ....See Entry 74127

Photometry of Cepheids in the LMC and Magellanic Cloud abundances ....See Entry 74155

Spectroscopy of variable blue stellar objects ....See Entry 74175

Stellar contributions to the hard X-ray galactic ridge ....See Entry 74181

97.60 LATE STAGES OF STELLAR EVOLUTION

(inc. black holes)

74089 Effect of a single coordinate system of curvature on the properties of the boundary between *R*- and *T*-regions and the energy-momentum tensor. S.N.E.Samoilov.
Ukr. Fiz. Zh. (USSR), vol.28, no.4, p.596-602 (April 1983). In Russian.
Gravitational collapse of a spherically symmetric star is considered. There is a world *T*-region which includes trapped regions, Γ_0 and Γ_i being the inner and outer boundaries of the *T*-region. It is supposed that the outer space-time is asymptotically flat, and the *R*-region is covered by a single curvature coordinate system. It is shown that Γ_0 and Γ_i are generated by isotropic world lines. (8 refs.)

97.60B Supernovae

74090 Infrared light curves of Type I supernovae. II. Late stages. J.H.Elias, J.A.Frogel (Cerro Tololo Inter-American Obs., Le Serena, Chile).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.718-20 (15 May 1983).
For pt.I see Astrophys. J. Lett. Ed., vol.251, no.1, pt.2, p.L13-L16 (1981). Infrared light curves of three Type I supernovae obtained by Elias et al. (1981) are extended to approximately 1 year after minimum light. The light curves and colors show no evidence for the development of an infrared excess. The very red *J-H* color observed roughly 100 days after maximum becomes bluer, probably indicating decreased absorption at 1.2 μm. (10 refs.)

74091 Barium from a mini *r*-process in supernovae. D.Heymann (Dept. of Geology, Rice Univ., Houston, TX, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.747-56 (15 April 1983).
The relative yields of the A=134, 135, 136, 137, and 138 isobars are calculated with an approximate model for the mini *r*-process which is thought to occur in the O, Ne-rich shell of a massive star during explosive burning. Neutron dose Φ_n is the primary parameter of the calculations. The isotopic anomaly of Ba in the EK-1-4-1 inclusion of the Allende meteorite demands comparable yields at A=135 and A=137 (McCulloch and Wasserburg, 1978). Near-equal yields occur in the calculations for $\Phi_n \approx 1.5 \times 10^{-7}$ mole cm^{-3} s and for $\Phi_n \gtrsim 10^{-6}$ mole cm^{-3} s. For the small neutron dose, the A=137 and A=138 yields are near-equal which implies an excess of ^{138}Ba in EK-1-4-1 of only 1-2 parts in 10^4. The small neutron dose is close to that for which the isotopically anomalous *r*-Xe in carbonaceous chondrites is formed by the same process (Heymann and Dziczkaniec, 1979, 1980, 1981). For the large neutron dose, the A=138 yield is an order of magnitude larger than the A=135 and A=137 yields, which is difficult to accept. Thus, the dilemma of the alarmingly large ^{138}Ba yield from an *s*-enhanced seed, noted by Lee et al. (1978), is resolved, provided that the neutron dose of the mini *r*-process in the O, Ne-rich zone of a supernova is an order of magnitude smaller than the doses typically deduced for standard explosive carbon burning. Implications for Nd and Sm anomalies in the EK-1-4-1 inclusion are discussed. (22 refs.)

74092 Radioactive models of Type I supernovae. S.R.Schurmann (Dept. of Astron. & Astrophys., Univ. of Chicago, Chicago, IL, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.779-94 (15 April 1983).
Numerical models of Type I supernovae are presented. The models consist of 0.8 $M_\odot$ of radioactive ^{56}Ni in a constant density core which expands homologously at $\leq$10000 km s^{-1}, and an envelope of 0.6 $M_\odot$ with a steep density gradient and a maximum velocity of 20000 km s^{-1}. Calculations are performed for both compact and extended initial configurations. Observations of Type I supernovae near maximum light indicate severe ultraviolet deficiencies, and bolometric corrections appropriate for blackbodies with zero flux shortward of 4000 Å are applied to the model bolometric light curves. The resulting *B*-band light curves are in good agreement with the observed light curves of SN 1972e and SN 1981b, and with a composite light curve for 'fast' Type I events. (57 refs.)

74093 Possible supernova in NGC 4258. E.Hummel, J.M.van der Hulst, R.D.Davies, A.Pedlar, G.D.van Albada, P.Wild.
I.A.U. Circ. (USA), no.3803, 1 pp. (9 May 1983).
The authors report the discovery of a variable radio source at $\alpha=12^h 16^m 31.16^s$, $\delta=+47°36'08.3''$ (equinox 1950.0), in the northern spiral arm of NGC 4258. The source was detected in a VLA observation in January 1982 at a level of 5.5 mJy, and confirmed at a level of 3 mJy by a WSRT observation in late 1982; a VLA observation in June 1979 does not show the source to a limit of 0.25 mJy. The source is either a variable background source or a supernova; if it is a supernova it must have appeared between late 1979 and late 1981. Its strength is about 15 times that of Cassiopeia A and comparable to that of the supernovae SN 1970g in M101 and SN 1980k in NGC 6946. Inspection of the Zimmerwald supernova patrol films of the area of NGC 4258 has revealed a 17th-magnitude star on 1981 November 3. The position of this object is $\alpha=12^h 16^m 31.33^s$, $\delta=+47°36'10.0''$ (equinox 1950.0), that is 17″ east and 76″ north of the nucleus of the galaxy, in excellent agreement with the radio position reported above. (1 ref.)

74094 Supernovae. E.P.Aksenov, J.Kielkopf, R.Brashaer, A.Goldstein, R.Gabart.
I.A.U. Circ. (USA), no.3813, 1 pp. (18 May 1983).
Reports the discovery of supernovae in NGC 6217 and NGC 4051. The supernova in NGC 6217 was at m_{pg}=15.1 on 1983 May 11, and is 4″ east and 12″ south of the nucleus of the galaxy. The supernova in NGC 4051 was at m_{pg}=15.0 on May 12, and is 21″ east and 50″ south of the nucleus of the galaxy. An independent detection of the supernova in NGC 4051 on May 11 is also reported; the photographic magnitude was 13.5 and the offset from the nucleus of the galaxy was measured as 23″ east and 53″ south. (no refs.)

NGC 1275: a burgeoning elliptical galaxy ....See Entry 74146

Sensitive mapping of E and S0 galaxies in search of H I content differences between supernovae and nonsupernovae producing galaxies ......See Entry 74148

97.60G Pulsars

74095 Further observations of the long-period binary pulsar PSR 0820+02. R.N.Manchester, L.M.Newton, D.J.Cooke (Div. of Radiophys., CSIRO, Sydney, NSW, Australia), P.R.Backus, M.Damashek, J.H.Taylor, J.J.Condon.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.832-6 (15 May 1983).
Observations of the second known orbiting pulsar, PSR 0820+02, now span just over 4 years, an interval comparable to the orbital period. Analysis of pulse arrival time data has produced accurate values of the celestial coordinates of the system, as well as the pulsar dispersion measure, period, slowdown rate, and orbital elements. The pulsar's position was also determined interferometrically by using the VLA, with results in accord with the timing data to better than the combined errors. The possible evolution of this orbiting system is discussed. (18 refs.)

74096 The period history of the X-ray pulsar in MSH 15−52. M.C.Weisskopf, R.F.Elsner, W.Darbro, D.Leahy, S.Naranan (Space Sci. Lab., NASA Marshall Space Flight Center, Huntsville, AL, USA), P.G.Sutherland, J.E.Grindlay, F.R.Harnden,Jr., F.D.Seward.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.711-12 (15 April 1983).
Presents new and refined measurements of the pulse period of the X-ray pulsar in the supernova remnant MSH 15−52. The X-ray data were taken with the Monitor Proportional Counter onboard the HEAO 2 (Einstein) Observatory. The X-ray measurements alone lead to a refined value of the period derivative of $(1.5382 \pm 0.0024) \times 10^{-12}$ s s^{-1}, while including the results of more recent radio observations leads to a value of $(1.54029 \pm 0.00095) \times 10^{-12}$ s s^{-1}. (8 refs.)

74097 Elongated beams, interpulses and the new millisecond pulsar. R.Narayan, V.Radhakrishnan (Raman Res. Inst., Bangalore, India).
Curr. Sci. (India), vol.52, no.2, p.46-9 (20 Jan. 1983).
The prominent interpulse of the new millisecond pulsar is consistent with very short period pulsars having fan-like beams, as suggested earlier by an independent study. All the available data on interpulse statistics support this picture, and also indicate that pulsars with perpendicular rotation and magnetic axes are absent at long periods. (13 refs.)

74098 PSR 1937+214. M.J.Lebofsky, G.H.Rieke.
I.A.U. Circ. (USA), no.3809, 1 pp. (13 May 1983).
It is reported that Djorgovski's (1982) candidate star is unlikely to be the optical counterpart of the millisecond pulsar PSR 1937+214. The authors report that the star has a photometric CO index of 0.19±0.03, and that it therefore probably has CO bands in absorption at 2.3 μm. The photometric colours and the CO band strength are consistent with the identification of the star as a K-type giant star reddened by 8 magnitudes. The optical position of the star indicates a small but probably significant offset from the radio position of the pulsar. (2 refs.)

MSH 15−52: a supernova remnant containing two compact X-ray sources ....See Entry 74128

97.60J Neutron stars

74099 Nonradial *g*-mode oscillations of warm neutron stars. P.N.McDermott, H.M.Van Horn, J.F.Scholl (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.837-48 (15 May 1983).
Adiabatic $l=1$ and 2, *p*-, *f*-, and *g*-mode fluid oscillations of finite-temperature neutron star models are computed. The authors use the 'relativistic Cowling approximation', defined in this paper, in which all perturbations of the gravitational potentials are neglected. This approximation is expected to be adequate for the *g*-modes and even gives reasonable results for the periods of *p*- and *f*-modes. For example, in agreement with previous calculations, the authors find the *p*-mode periods to be approximately $\Pi_p \sim 0.5(M_*/M_\odot)^{-1/2}R_6^{3/2}$ ms, where R_6 is the neutron star radius in units of 10^6 cm. For the *g*-modes, the periods from the numerical calculations are $\gtrsim 400$ ms for a neutron star with $T_7 \approx 1.0$ and vary roughly as the inverse of T_7, where T_7 is the core temperature in units of 10^7K. The authors have also estimated the gravitational radiation damping times, τ, of the $l=2$ oscillation modes. For the *p*- and *f*-modes they find, again in rough agreement with previous calculations, $\tau \sim (10^2\text{-}10^3)\Pi$. For the fluid *g*-mode oscillations, however, gravitational radiation damping is exceedingly weak, with typical values of τ greatly exceeding the age of the Universe. (38 refs.)

74100 Neutron diffusion and heat transfer in the crusts of neutron stars. G.S.Bisnovatyi-Kogan, M.M.Romanova (Inst. of Cosmic Res., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.56, no.2, p.243-8 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.449-59 (Aug. 1982). [received: May 1983]
The coefficients that determine the neutron heat transfer and diffusion in the crusts of neutron stars are calculated on the basis of a solution of the Boltzmann equation with allowance for degeneracy. Exact expressions are obtained for the cases of strong and weak degeneracy together with interpolation formulas valid for all values of the degeneracy parameter. (14 refs.)

Magnetic fields in astrophysics ....See Entry 73988
Orbital period changes in Centaurus X-3 ....See Entry 74104
The central X-ray source in RCW 103: evidence for blackbody emission ....See Entry 74180
Stellar contributions to the hard X-ray galactic ridge ....See Entry 74181

97.60L Black holes

74101 Stationary axially symmetric perturbations of the Reissner-Nordstrom black hole. II. Odd-parity perturbations generated by special sources. L.Dvorak (Faculty of Math. & Phys., Charles Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.5, p.510-27 (1983).
For pt.1 see ibid., vol.33, p.327 (1983). The solution of the decoupled equations for the odd-parity electromagnetic and gravitational perturbations of the extreme Reissner-Nordstrom black hole is given outside the region of the source. The perturbations of the metric tensor and the electromagnetic field tensor have the form of multipole expansions. The coefficients of the expansions are given explicitly for several concrete sources (current loops and rotating loops of matter). The multipole expansions are then summed up numerically and magnetic fields generated by the sources are characterized graphically by lines of force constructed numerically. Some features of the perturbations of a general Reissner-Nordstrum black hole are also discussed. (11 refs.)

74102 Temperature dependent gravitational constant and black hole physics. A.K.Raychaudhuri, B.Bagchi (Dept. of Phys., Presidency Coll., Calcutta, India).
Phys. Lett. B (Netherlands), vol.124B, no.3-4, p.168-70 (28 April 1983).
Examines the thermodynamics of black holes in case of a varying gravitational constant. The authors find that the second law thermodynamics may remain valid contrary to the opinions expressed by some. (9 refs.)

Entropy bounds and the second law for black holes ....See Entry 69950
Entropy bounds, acceleration radiation, and the generalized second law ....See Entry 69951
The question of an upper bound on entropy ....See Entry 70024
Magnetic fields in astrophysics ....See Entry 73988
Monte Carlo simulations of the evolution of galactic nuclei containing massive, central black holes ....See Entry 74140
The ultraviolet excess of luminous quasars. II. Evidence for massive accretion disks ....See Entry 74169

97.80 BINARY AND MULTIPLE STARS

(inc. extrasolar planetary systems)

74103 X-ray properties of the Be/X-ray system 2S 0114+650=LSI+65°010. G.Koenigsberger, J.H.Swank, A.E.Szymkowiak, N.E.White (Lab. for High Energy Astrophys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.782-9 (15 May 1983).
Results are presented from experiments on the Einstein Observatory, HEAO 1, and OSO 8 on the temporal and spectral properties of 2S 0114+650. In a 12 hr Einstein monitor proportional counter and solid state spectrometer observation, two episodes of flaring occurred by an order of magnitude over about 1 hr. Variability on shorter time scales showed a preferred period of 14.9 minutes, but periodic pulsations were not seen in the HEAO 1 and OSO 8 data. The spectra above 1 keV were typical of accreting X-ray pulsars, a power law $E^{-\alpha}$ with $\alpha \sim 1.2$ for the number spectrum up to a cutoff at ~14 keV. There is some evidence that the spectrum is steeper when the source is quiescent at low luminosity, but no large spectral changes attended the flares. Absorption column densities were consistent with interstellar reddening of the proposed companion, the Be star LSI+65°010. In the minute and hour variability and in the spectral character, 2S0114+650 is similar to other Be star-neutron star binary X-ray sources. Variations over several days in the OSO 8 data suggest orbital effects. (40 refs.)

74104 Orbital period changes in Centaurus X-3. R.L.Kelley, S.Rappaport, G.W.Clark, L.D.Petro (Dept. of Phys., MIT, Cambridge, MA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.790-9 (15 May 1983).
The authors present two new times of mid-X ray eclipse for Cen X-3 based on pulse arrival time analyses of pointed observations with SAS 3. These results, when combined with all other published eclipse times based on Doppler delay measurements, show that the 2.1^d binary period is decreasing at an average rate of $\dot{P}_{orb}/P_{orb} = -1.8 \times 10^{-6}$ yr^{-1}, but with apparently significant fluctuations about a smooth, linear decrease. The observed changes in the orbital period can be accounted for by mass loss from the systems through the L_2 point, although the required rates are implausibly high. It is also shown that the long-term overall orbital decay can be readily interpreted as the result of torques exerted by the tidally distorted companion star (Krzeminski's star) on the orbiting neutron star. The inferred asynchronism between the orbital frequency and the rotation frequency of the companion star may be maintained by mass and angular momentum loss in a stellar wind, or by a tidal instability related to the Darwin effect. However, this scenario would not provide a natural explanation for any short-term deviations from a constant rate of orbital decay. The implications of an inferred shrinking critical potential lobe around Krzeminski's star are discussed. (62 refs.)

74105 Chromospheric emission of W Ursae Majoris-type stars and its relation to the structure of their common envelopes. J.A.Eaton (Dept. of Phys. & Astron., Vanderbilt Univ., Nashville, TN, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.800-6 (15 May 1983).
The author has analyzed short-wavelength IUE spectra of 14 W UMa binary systems. All but the A2 V system GK Cep and possibly the A8 system AG Vir show chromospheric and transition-region emission lines. This property extends to at least as early as A8-9. The luminosity in transition-region emission lines is roughly proportional to bolometric luminosity. The strength of transition-region emission relative to chromospheric emission is roughly independent of spectral type and is at least as great as for other stars with enhanced surface activity. The enhanced chromospheric activity and light curve peculiarities of the hotter systems seem to disagree with the predictions of the contact-discontinuity models for contact binary structure. (42 refs.)

74106 Detection of flare like events and their relationship to presumed spot regions on V471 Tau: a solar-stellar connection. A.Young (High Altitude Obs., Nat. Center for Atmospheric Res., Boulder, CO, USA), A.Klimke, J.L.Africano, R.Quigley, R.R.Radick, D.van Buren.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.655-64 (15 April 1983).
High speed photometric observations of the eclipsing binary V471 Tau were made with the intent of detecting flares similar to those which have been reported in the literature by various observers over several years. Two such flare events were observed at a 3 σ detection level. A search of the literature uncovered five other reliably reported events. A study of the occurrence times of these events in terms of the ephemeris of the photometric wave that is known to migrate through the light curve of V471 Tau reveals a strong correlation, suggesting that the flares occur near regions of the K dwarf where spot groups are inferred. The evidence suggests that active regions similar to those observed on the Sun occur on V471 Tau but with considerably greater magnitude. A new periodic study strongly implies that the system is subject to abrupt period changes interspersing long intervals of period constancy. A new linear ephemeris is derived. New X-ray observations of the coronal radiation from the dwarf K star are also reported and discussed. (35 refs.)

74107 First observations of stellar coronal structure: the coronae of AR Lacertae. F.M.Walter (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA), D.M.Gibson, G.S.Basri.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.665-81 (15 April 1983).
Makes Einstein IPC observations of the X-ray eclipses of the RS CVn binary AR Lacertae. These data, together with contemporal IUE and radio observations, for the first time allow reasonable estimates of the structures of coronae of other solar-like stars. The X-ray luminosities of the G2 IV-V and the K0 IV components. Both components appear to have coronae with scale heights small compared to the stellar radius. Both the coronal and chromospheric surface fluxes appear to be inhomogeneous across the surfaces of the stars. (44 refs.)

74108 HR 7578: a K dwarf double-lined spectroscopy binary with peculiar abundances. F.C.Fekel,Jr. (Lab. for Astron. & Solar Phys., NASA Goddard Space Flight Center, Greenbelt, MD, USA), W.I.Beavers.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.682-90 (15 April 1983).
HR 7578 is a double-lined K2-3 V binary with a period of 46.8 days, an eccentricity of 0.69, and minimum masses for the components of 0.85 ± 0.03 $M_\odot$. Taylor (1970) classified the object as super-metal-rich and noted its unusually strong CN and sodium lines DDO photometry confirms the extremely strong CN. The age of the system is estimated. Like several recently discovered Hyades binaries, the minimum masses of the components of HR 7578 are larger than the typical values previously assumed for the spectral type. HR 7578 lies 0.5 mag below the field star mass-luminosity relation, a position similar to that of those Hyades spectroscopic binaries with the large minimum masses. (52 refs.)

74109 X-ray burst observations of Serpens X-1. M.Sztajno, E.M.Basinska, L.R.Cominsky, F.J.Marshall, W.H.G.Lewin (Dept. of Phys., MIT, Cambridge, MA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.713-25 (15 April 1983).
Fifty-seven X-ray bursts observed with SAS 3 in the period 1976 July to 1979 March are reported. Their general features and the relations between them are discussed. Also a comparison is made between these burst features and the associated persistent X-ray flux. The latter appears to be correlated with the maximum burst flux; the temperature of the plasma that produces the persistent flux is roughly proportional to this flux. (62 refs.)

74110 The short-period eclipsing system XY UMa: 1982 *UBV* light curves and a flare-like event. M.Zeilik, R.Elston, G.Henson (Dept. of Phys. & Astron., Univ. of New Mexico, Albuquerque, NM, USA).
Astron. J. (USA), vol.88, no.4, p.532-4 (April 1983).
The authors observed the short-period eclipsing system XY UMa (which displays RS CVn phenomena) on two nights in early 1982 at *UBV* bands. The light curves show both primary and secondary eclipses are asymmetrical and that a distortion wave of small amplitude has a minimum near phase 0.25. On the night of 1/31/82, the authors recorded a flare-like episode at phase 0.57 whose duration was about 30 minutes. The total energy in the outburst was about 9% of the system's flux at *U*, 4% at *B*, and 3% at *V*. (23 refs.)

74111 A *UBV* photoelectric investigation of the eclipsing binary system DM Virginis. R.L.Walker (US Naval Obs., Flagstaff Station, Flagstaff, AZ, USA), C.R.Chambliss.
Astron. J. (USA), vol.88, no.4, p.535-41 (April 1983).
DM Vir is a detached eclipsing binary system consisting of two almost identical F6-7 IV-V components. Its period is shown to be about 4.6694^d. Light curves in *UBV* are analyzed by the Wood method. The eclipses are complete and nearly central. The primary eclipse is an occultation and the duration of the complete phase of the eclipses is about 10 minutes. The absolute dimensions of the components are derived and these are shown to be similar to those of the subgiant Procyon. Although DM Vir cannot be regarded as a RS CVn system at present, it is seen as a precursor of this type of star. (18 refs.)

74112 Astrometric studies of ten double or suspected multiple systems from plates taken with the Sproul 61-cm refractor. S.L.Lippincott (Sproul Obs., Swarthmore Coll., Swarthmore, PA, USA).
Astron. J. (USA), vol.88, no.4, p.542-5 (April 1983).
Eight of ten Sproul series of double or suspected multiple systems yield parallaxes with no previously published values from other observatories. Eight systems are unresolved on the photographic plate, one is resolved with the faint component showing magnitude variability, while the remaining system shows elongated images. Only two systems have visual orbit determinations. U CrB, a spectroscopic binary, is suspected to have a distant companion from the orbital period changes, possibly caused by light time variations; the existence of an unseen companion cannot be verified astronomically with the Sproul data. (9 refs.)

74113 The partial phase of the eclipse of epsilon Aurigae. R.D.Chapman, Y.Kondo (Lab. for Astron. & Solar Phys., NASA Goddard Space Flight Center, Greenbelt, MD, USA), R.E.Stencel.
Astrophys. J. Lett. Ed. (USA), vol.269, no.1, pt.2, p.L17-19 (1 June 1983).
Ultraviolet spectra of the peculiar eclipsing binary ϵ Aurigae (F0 Ia+?) were obtained with the International Ultraviolet Explorer at pre-eclipse and ingress partial phases. The results show a wavelength dependence of the eclipse in contrast to the grayness (non-wavelength dependence) of the eclipse observed in visible light. From the current results, incorporating previous observations, the authors suggest that: (a) the obscuration of the light of the F supergiant by the disk proposed by Huang (1965) is the result of electron scattering in visible light; (b) the increase in the eclipse depths toward shorter wavelengths observed in the ultraviolet is caused by dust; and (c) the temperature of the disk is in the range from 1000 to 2000K. (13 refs.)

74114 Photoelectric minima times of the eclipsing binary V508 Ophiuchi. P.Rovithis (Nat. Obs. of Athens, Athens, Greece), H.Rovithis-Livaniou.
Inf. Bull. Variable Stars (Hungary), no.2317, pp.1 (20 April 1983).
The authors report times of three primary minima and three secondary minima of the W Ursae Majoris star V508 Ophiuchi, obtained from photoelectric BV photometry during 1981. In addition, O−C values, calculated from the ephemeris of Kukarkin, are presented. (3 refs.)

74115 Epochs of minimum light for several eclipsing binaries. D.R.Faulkner, R.H.Kaitchuck (Astron. Dept., Indiana Univ., Bloomington, IN, USA).
Inf. Bull. Variable Stars (Hungary), no.2321, pp.2 (22 April 1983).
The authors report photoelectric times of minimum light for six eclipsing binary stars, namely BX Andromedae, U Cephei, V366 Cygni, TZ Eridani, SW Lacertae and RW Tauri. These minimum light times were obtained between 1976 September 12 and 1982 October 22 by means of UBV photometry. (7 refs.)

74116 A field guide to the binary stars. V.Trimble (Astron. Program., Univ. of Maryland, College Park, MD, USA).
Nature (GB), vol.303, no.5913, p.137-42 (12 May 1983).
For most of the history of binary star astronomy, systems have been classified largely on the basis of how they were discovered and qualitative appearance of their spectra and light curves. Understanding of single and double star evolution has now progresed to the point where most of the classes previously identified, and some new ones, can be arranged into evolutionary sequences, depending primarily on the initial masses and separation of the component stars. (163 refs.)

74117 Post-Newtonian gravitational radiation of a system of two compact objects in the field theory of gravitation. A.A.Vlasov (Sci.-Res. Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Theor. & Math. Phys. (USA), vol.52, no.3, p.888-93 (Sept. 1982). Translation of: *Teor. & Mat. Fiz. (USSR)*, vol.52, no.3, p.414-22 (Sept. 1982). [received: May 1983]
The gravitational radiation of a binary system of static spherically symmetric bodies whose sizes are small compared with their separation is studied in the post-Newtonian approximation in the field theory of gravitation. (5 refs.)

On the stability of close binaries in hierarchical three-body systems ....See Entry 73971

On the double averaged three-body problem ....See Entry 73976

Orbital periods of novae before eruption ....See Entry 74071

The minimum period and the gap in periods of cataclysmic binaries ....See Entry 74073

An Hα survey of southern hemisphere active chromosphere stars ....See Entry 74075

Time-resolved spectrophotometry of the emission lines in the galactic X-ray source H 2252−035 ....See Entry 74076

CNO abundances and the strengths of nova outbursts and hydrogen flashes on accreting white dwarfs ....See Entry 74077

Six variable stars discovered in binary systems ....See Entry 74085

Observations of four variable stars in binary systems ....See Entry 74086

Photometry of a Si-Ap variable ....See Entry 74088

Further observations of the long-period binary pulsar PSR 0820+02 ....See Entry 74095

Stellar contributions to the hard X-ray galactic ridge ....See Entry 74181

97.90 OTHER TOPICS IN STELLAR ASTRONOMY

74118 UBVRI photometric standard stars around the celestial equator. A.U.Landolt (Louisiana State Univ., Baton Rouge, LA, USA).
Astron. J. (USA), vol.88, no.3, p.439-60 (March 1983).
UBVRI photoelectric observations have been made of 223 stars mostly in an approximate two degree band centered in the celestial equator. The observing program was planned to provide new UBVRI standard stars, available to telescopes of a variety of sizes in both hemispheres, on an internally consistent homogeneous system around the sky. Most of the stars are in Selected Areas 92-115. The stars average 20.7 measures each on 12.2 different nights. The stars in this paper fall in the range $7 \lesssim V \lesssim 12.5$ and $-0.3 \lesssim (B-V) \lesssim +2.0$. (95 refs.)

NGC 1275: a burgeoning elliptical galaxy ....See Entry 74146

A color-magnitude diagram for Leo II ....See Entry 74150

98.00 STELLAR SYSTEMS; GALACTIC AND EXTRAGALACTIC OBJECTS AND SYSTEMS; THE UNIVERSE

98.10 STELLAR DYNAMICS

74119 On the equilibrium configurations of prolate, axisymmetric stellar systems. C.L.Bohn (Dept. of Astron. & Astrophys., Univ. of Chicago, Chicago, IL, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.646-66 (15 May 1983).
Constructs and describes a family of equilibrium configurations of nonrotating, axisymmetric, prolate stellar systems. The family spans mass distributions which range from nearly homogeneous configurations through configurations having compact cores surrounded by relatively tenuous envelopes of infinite extent. The prolate shapes span the range of ellipticities observed in elliptical galaxies. (43 refs.)

98.20 STELLAR CLUSTERS AND ASSOCIATIONS

74120 NGC 6067 and three Cepheids. O.J.Eggen (Cerro Tololo Inter-American Obs., La Serena, Chile).
Astron. J. (USA), vol.88, no.3, p.379-85 (March 1983).
NGC 6067 is a small, compact cluster some 6×10^7 yr old and, at a distance of 1.25 kpc, is superposed on, but a kpc closer than, the association Norma OB1. Several of the unusual features noted in the color-luminosity array by Thackeray, Wesselink, and Harding are caused by including association stars among the cluster members. A newly discovered Cepheid, CPD −53°7400 A (11.3^d), is a central star in the cluster but is a member of the more distant association, as is the Cepheid GN Nor (3.4^d). HD 144972 (3.8^d), a newly discovered Cepheid on the border of the cluster, is probably a cluster member. The new variable, −57°7400 A, is compared with the bright, small amplitude Cepheid ζ Gem in an appendix. (23 refs.)

74121 Search for new variable stars in NGC 5927, 5946, and 6144. M.H.Liller (Harvard-Smithsonian Center for Astrophys., Cambrige, MA, USA).
Astron. J. (USA), vol.88, no.3, p.404-9 (March 1983).
New searches have been made for variable stars in the region of the globular clusters NGC 5927, 5946, and 6144. No new variables were found in NGC 5927, which appears to contain only slow, red variables. Four new variables were found within the tidal radius of NGC 5946, of which one and possibly a second are RR Lyrae types. One of the previously known variables is also of this type. In addition seven new field variables were found in the outskirts of NGC 5946. In the region of NGC 6144, one new slow variable was discovered; the previously known variable is probably of RR Lyrae type, but is probably not a cluster member. (18 refs.)

74122 The Cyanogen inhomogeneity of NGC 362. G.H.Smith (Mount Stromlo & Siding Spring Obs., Australian Nat. Univ., Woden, Australia).
Astron. J. (USA), vol.88, no.3, p.410-17 (March 1983).
The cyanogen distribution among the subgiants in NGC 362 has been investigated by using a panoramic photometry technique employing narrowband filters designed to measure the strength of the λ 3883 CN band. This distribution is found to be bimodal, with a heavy preference towards CN-rich stars. The cyanogen variations are found among giants two magnitudes fainter than the Sweigart and Mengel critical luminosity at which CN surface abundance variations are predicted to first appear. (40 refs.)

Photography in the Washington system ....See Entry 73998

Pseudocepheids. I. R Puppis, HR 4441, HR 4511, and AI CMI ....See Entry 74079

Globular cluster orbits and the galactic mass distribution ....See Entry 74151

98.40 INTERSTELLAR MATTER; AND NEBULAE

74123 Distribution of forbidden neutral carbon emission in the Ring Nebula (NGC 6720). D.C.Jewitt (Palomar Obs., California Inst. of Technol., Pasadena, CA, USA), P.N.Kupferman, G.E.Danielson, S.P.Maran.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.683-8 (15 May 1983).
The spatial distribution of [C I] 9823, 9850 Å emission in NGC 6720 is reported. Like [O I], the [C I] radiation appears enhanced in the region of the bright filaments. A few percent of the carbon atoms in the filaments are neutral. This neutral fraction is consistent with ionization equilibrium calculations made under the assumption of complete shielding of direct stellar radiation by hydrogen. The observed carbon lines are excited by photoelectrons produced from hydrogen by the nebular diffuse radiation field. The [C I] observations confirm that the filaments in NGC 6720 are regions of locally enhanced shielding. (15 refs.)

74124 Interstellar Hα emission along the galactic equator. R.J.Reynolds (Phys. Dept., Univ. of Wisconsin, Madison, WI, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.698-709 (15 May 1983).
Hα emission-line profiles were obtained at 2° intervals from galactic longitude 0° to 240° at $b=0°$. Galactic Hα emission was detected in every direction with an intensity that ranged from 7.5×10^{-7} ergs cm^{-2} s^{-1} sr^{-1} at $l=44°$ and 154° to 1.2×10^{-4} ergs cm^{-2} s^{-1} sr^{-1} at 86°. Variations in the intensity along the galactic equator reveal many faint emission regions with electron densities of ~1-3 cm^{-3}, which appear to be superposed on a more uniform Hα background requiring an rms electron density of ~0.1 cm^{-3}. The radial velocities of the emission components indicate that both the diffuse background and the more discrete emission regions are concentrated in the spiral arms. These data complement photographic and radio surveys by providing absolute Hα intensities and radial velocities in 121 evenly spaced, 0.8° diameter fields down to a limiting emission measure of about 2 cm^{-6} pc. (29 refs.)

74125 IR maps of M17 in the [O III] 88 micron and 52 micron lines and [N III] 57 micron line measurements. R.J.Emery, D.A.Naylor, B.Fitton (Space Sci. Dept., ESA, Noordwijk, Netherlands), I.Furniss, R.E.Jennings, K.J.King.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.721-6 (15 May 1983).
Observations of the IR fine-structure lines of [O III] and [N III] from M17 were made using a balloon-borne 60 cm diameter telescope and a Michelson interferometer of 0.05 cm^{-1} resolution. The FWHM beam size was 1′.65. These data are combined with earlier published data on these lines from airborne and balloon observations to provide the first extensive far-IR line maps of M17 and an electron density map derived from the [O III] line ratios. (18 refs.)

74126 Warm H I halos around molecular clouds. P.G.Wannier, S.M.Lichten (Dept. of Astron., California Inst. of Technol., Pasadena, CA, USA), M.Morris.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.727-38 (15 May 1983).
Observations of H I have been made with the 305 m Arecibo dish toward the isolated edges of several molecular clouds. Comparison with 1.3 and 2.6 mm CO line emission indicates the existence of H I halos extending 0.5 to several pc beyond the CO boundaries. Because the halos appear in emission against the ~100K galactic H I background, the gas is evidently warmer than much of the interstellar H I gas. The observed column densities and transition zone thicknesses agree well with steady state calculations equating the formation rate of H_2 on grains to its destruction by UV radiation. (29 refs.)

74127 Stellar winds and molecular clouds: T Tauri stars. N.Calvet (Centro de Investigacion de Astron., Merida, Venezuela), J.Canto, L.F.Rodriguez.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.739-52 (15 May 1983).
The authors have searched for high-velocity molecular gas in the environment of 12 T Tauri stars associated with optical nebulosities. The molecular gas associated with T Tau and HL and XZ Tau clearly showed carbon monoxide line wings extending at least over ~ 15 km s^{-1}. HL and XZ Tau are located in the molecular cloud L 1551, where an independent outflow powered by an infrared source has been reported. The existence of two separate centers of gas outflow in L1551 suggests that the phenomenon is common. The rate of momentum being injected by stars as T Tau and HL and XZ Tau into their molecular surroundings is large, $\gtrsim 10^{-6}$ $M_{\odot}$ km s^{-1} yr^{-1}. These rates are higher than those expected from the radiative momentum rate of the stars alone, but comparable with those derived from optical observations of T Tau winds. (56 refs.)

74128 MSH 15−52: a supernova remnant containing two compact X-ray sources. F.D.Seward, F.R.Harnden,Jr. (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA), P.Murdin, D.H.Clark.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.698-710 (15 April 1983).
Einstein observations show two small-diameter, bright X-ray sources within the shell of the galactic radio supernova remnant (SNR) MSH 15−52. X-ray spectra and optical extinction indicate that both compact sources are at least as distant, 4.2 kpc, as the diffuse emission from the shell. There is also enhanced, diffuse emission in the vicinity of both compact sources, as well as coincident with the radio shell. The source closest to the middle of the remnant is hard, was previously detected as 4U 1510−59, and shows strong regular X-ray pulsations with a period of 0.150 s. The second source is associated with a collisionally excited, high-density, optical knot within the Hα nebula RCW 89 close to the northwestern rim of the SNR. CCD observations with the Anglo-Australian Telescope yield possible reddened candidates for 4U 1510−59 and map the optical knot. UK Schmidt telescope photographs of RCW 89 show new filaments which extend into MSH 15−52 and support the hypothesis that the Hα nebula is part of the whole SNR. The authors discuss the interaction of the supernova ejecta with the interstellar medium, the possibility that the ages of the pulsar and the SNR are less discrepant than they first appear, and the possibility that a second pulsar powers the knot and RCW 89. (55 refs.)

74129 The structure of bright-rimmed molecular clouds. A.Wootten, A.Sargent, G.Knapp (Owens Valley Radio Obs., California Inst. of Technol., Pasadena, CA, USA), P.J.Huggins.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.147-64 (1 June 1983).
Five bright-rimmed molecular clouds, NGC 1977, IC 1396, IC 1848A, B35, and NGC 7822, have been mapped with 30″ resolution in the $J=2$-1 lines of ^{12}CO. For the first three, ^{13}CO maps have also been made. The spatial distributions of temperature, density, and molecular abundance in these clouds are determined, particularly in the vicinity of the rims. In general, the gas densities increase close to the rims, but temperature enhancements occur over comparatively extended regions. Near the rims the gas kinematics is varied: velocity gradients are observed in several regions, and in IC 1396 line broadening is distinguishable. A detailed study of the excitation of ^{13}CO demonstrates that near the well-resolved rim in NGC 1977 where C I and carbon recombination lines have been observed, there is a definite decline in the CO abundance. (56 refs.)

74130 A study of Hα velocities in NGC 1499, NGC 7000, and IC 1318B/C. W.F.Fountain, G.A.Gary, C.R.O'Dell (NASA, George C. Marshall Space Flight Center, AL, USA).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.164-74 (1 June 1983).
Multiple slit echelle spectrograph observations of the Hα emission line are used to map the radial velocities of the California Nebula (NGC 1499), the North American Nebula complex (NGC 7000 and IC 5070), and IC 1318B/C. The California Nebula is singularly constant in velocity, considering its geometry. The North American Nebula complex reflects a very simple, classical dynamical picture. The expansion discovered earlier in IC 1318B/C is confirmed, detailed, and the model refined. (38 refs.)

74131 The M17 SW molecular cloud. H.A.Thronson,Jr. (Wyoming Infrared Obs., Univ. of Wyoming, Laramie, WY, USA), C.J.Lada.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.175-81 (1 June 1983).
Reports ^{12}CO and ^{13}CO observations of the massive molecular cloud associated with the giant M17 H II region. The authors find the brightest ^{12}CO emission to lie in an elongated ridge, parallel and adjacent to a sharp ionization front at the apparent H II/H_2 interface. The highest temperature ^{12}CO emission is coincident with the brightest 100 μm emission. That this was not seen in earlier, lower resolution ^{12}CO maps suggest a very steep molecular temperature gradient across the ionization front and emphasizes the uncertainties of using finite-sized beams. With the new data the molecular dissociation front is located. The radio molecular data also support the idea of a dusty molecular cloud that is largely externally heated by the exciting stars of the M17 H II region. These enormously luminous stars may be masking significant star-forming activity within the molecular cloud itself. (25 refs.)

74132 The surface brightness of reflection nebulae: NGC 1432 and the 17 Tauri nebulosity. M.J.Cottrell (BDM Corp., Columbia, MD, USA), A.N.Witt.
Astron. J. (USA), vol.88, no.3, p.418-26 (March 1983).
New photoelectric surface brightness measurements of the reflection nebulae near 20 Tau and 17 Tau are reported for intermediate width bandpasses centered near 3500, 4100, 4700, and 5500 Å. The derived surface brightness distributions have been used to set limits on the density and the spatial extent of the dust clouds near these stars. NGC 1432 (20 Tau) can be represented successfully by either an inclined plane-parallel dust slab with the star in front or by an extended, optically thin spherical shell surrounding 20 Tau. The 17 Tau nebulosity is most easily modelled by an extended spherical cloud of low uniform density. A comparison of the absolute surface brightness of four reflection nebulae, NGC 7023, NGC 1435, NGC 1432, and the 17 Tau nebulosity, shows the latter two to be relatively inefficient producers of scattered light. (33 refs.)

74133 Intensity and extinction irregularities in the H_2 emission from Orion. H.A.Smith (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA), H.P.Larson, M.A.Feierberg, U.Fink.
Astron. J. (USA), vol.88, no.3, p.469-675 (March 1983).
Fourteen lines of the $\nu=1$-0 and $\nu=2$-1 2 μm H_2 quadrupole spectrum were measured in a series of ground-based spectroscopic observations of four locations within the Orion molecular cloud-H_2 emission complex. Beam sizes of 7″ and 10″ were used, with a resolution of 1.8 cm^{-1}. The results indicate that there are differences in the extinction between regions of as much as $\delta A_V \simeq 20$ mag. In particular there appears to be a ridge of material near the object IRS 2 (=IR*c* 9), a previously suggested source of activity. The 2-1 S (3) line intensity is substantially stronger at Peak 2 than the present models predict, and this observation is the first indication that there may be a non-Boltzmann distribution within the vibrational levels of shock-excited H_2. The authors also report a detection of the 1-0 Q (6) line, a feature which was previously absent in spectra of the Orion cloud. (25 refs.)

74134 High-velocity iron absorption lines in supernova remnant 1006. C-C.Wu (Computer Sci. Corp., Baltimore, MD, USA), M.Leventhal, C.L.Sarazin, T.R.Gull.
Astrophys. J. Lett. Ed. (USA), vol.269, no.1, pt.2, p.L5-9 (1 June 1983).
The International Ultraviolet Explorer spectrum of the Schweizer-Middleditch star projected near the center of supernova remnant 1006 shows an sdOB star continuum, with very strong, broad absorption lines. Strong Fe^{+} resonance abosorption lines are present. Their centers show zero radial velocity, while their profiles are broadened by ~ 5-6×10^{3} km s^{-1}. Redshifted $Si^{+,+2,+3}$ lines at $\nu_r \sim 5\times 10^{3}$ km s^{-1} have also been tentatively identified. The authors argue that the absorptions must occur in the ejecta of the supernova. The strength and symmetric width of the Fe^{+} lines suggest that the bulk of the ejecta is iron, in agreement with the current theory for the origin of Type I supernovae. The previous failure to detect strong Fe emission lines in the X-ray spectrum of this and other young Type I SNRs suggests that the ejecta may not have had time to interact significantly with the ambient medium. (13 refs.)

74135 Detection of interstellar NH_3 in the far-infrared: warm and dense gas in Orion-KL. C.H.Townes, R.Genzel, D.M.Watson (Dept. of Phys., Univ. of California, Berkeley, CA, USA), J.W.V.Storey.
Astrophys. J. Lett. Ed. (USA), vol.269, no.1, pt.2, p.L11-15 (1 June 1983).
Reports the detection of the $(J,K)=a(4,3)\rightarrow s(3,3)$ rotation-inversion transition of ammonia at 124.6 μm towards the center of the Orion-KL region. The far-IR ammonia line emission probably comes mainly from the 'hot core', a compact region of warm, very dense gas previously identified by the radio inversion lines of NH_3. The $a(4,3)\rightarrow s(3,3)$ line is very optically thick $(\tau \sim 10^{3})$, and since it is seen in emission, radiative excitation of the (4,3) NH_3 level by far-IR emission from dust within the source can be ruled out. The (4,3) level is probably collisionally excited and the gas in the hot core region is warmer than the dust. Densities of $\sim 10^{7}$ cm^{-3} are high enough to explain the observations. Shock heating by the mass outflow from IRc2 may account for the high gas temperatures in the hot core region. (26 refs.)

74136 Magellanic Cloud planetary nebula with suspected strong forbidden iron lines. L.H.Aller (Astron. Dept., Univ. of California, Los Angeles, CA, USA), S.J.Czyzak.
Proc. Natl. Acad. Sci. USA, vol.80, no.6, p.1764-6 (March 1983).
The relatively high-excitation nebula (Westerlund-Smith object 25) in the Large Magellanic Cloud shows prominent forbidden lines of [ArIV], the close [Ne IV] pair λ4724, 4726, [Ca V] λ5309, [Fe V] λ4227, and probably [Fe VI] and [Fe VII], as well. A conventional interpretation of observations secured with a vidicon detector at the Cerro Tololo 4-m telescopes indicates an essentially 'normal' helium abundance but depletions of N, O, Ne, and other elements with respect to the Galaxy. When a comparison is made with diffuse neblae of H II regions in the Large Magellanic Cloud, the authors find helium to be more abundant, oxygen to be depleted, and nitrogen, neon, and argon to be comparable. The abundance of sulfur is uncertain. Iron in the gaseous phase is certainly more plentiful than in conventional planetaries. (15 refs.)

74137 The densities of charged particles in very dense interstellar clouds. T.Umebayashi (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.2, p.480-502 (Feb. 1983).
The author examines the following proceses on the grain surface: the adsorption of ions and electrons to the surface; the recombination of ions and electrons at grain-ion, grain-electron and grain-grain collisions; and desorption of ions and electrons from the surface. As the temperature increases, the sticking probability of electrons to the surface is found to decrease to 0.1 or lower, while that of ions remains very close to unity. Above a certain critical temperature around several hundred kelvin, the desorption becomes abruptly efficient. Solving the rate equations for chemical and grain-surface reactions, the author investigates the abundances of various charged particles in very dense interstellar clouds (protostars). As long as the desorption is inefficient, grains with one excess ion and with one excess electron are the major constituents among charged particles at densities higher than 10^{10} cm^{-3}. When the desorption becomes efficient, electrons and ions in the gas phase increase extensively as charged grains decrease. At the temperature above about 10^{3}K the thermal ionization dominates over the other processes of ionization, and the ionization degree increases extensively with the temperature. (20 refs.)

Relativistic thermal plasmas: effects of magnetic fields ....See Entry 73986

Magnetic fields in astrophysics ....See Entry 73988

An atlas of H II regions in 125 galaxies ....See Entry 74000

HH 1 and HH 2: the results of an eruptive event in the Cohen-Schwartz star? ....See Entry 74067

Further observations of the long-period binary pulsar PSR 0820+02 ....See Entry 74095

The period history of the X-ray pulsar in MSH 15−52 ....See Entry 74096

X-ray properties of the Be/X-ray system 2S 0114+650=LSI+65°010 ....See Entry 74103

The distribution of ionized gas in the nuclei of spiral galaxies ....See Entry 74143

Sensitive mapping of E and S0 galaxies in search of H I content differences between supernovae and nonsupernovae producing galaxies ......See Entry 74148

Neutral hydrogen in isolated galaxies. II. The large angular diameter galaxies ....See Entry 74149

On the evolution of the spiral galaxies in the Virgo cluster .....See Entry 74153

21-cm observations of galaxies in groups and multiplets ....See Entry 74154

Photometry of Cepheids in the LMC and Magellanic Cloud abundances ....See Entry 74155

21 centimeter observations of supercluster galaxies: the bridge between Coma and A1367 ....See Entry 74164

CO observations of the galaxies in the Leo triplet: NGC 3623, NGC 3267, and NGC 3628 .... See Entry 74165

Observations of low redshift H I in Stephan's Quitent .... See Entry 74166

The central X-ray source in RCW 103: evidence for blackbody emission .... See Entry 74180

Einstein observations of the rho Ophiuchi dark cloud. An X-ray Christmas tree .... See Entry 74182

Solrad 11 observations of the far-ultraviolet background .... See Entry 74183

98.50 THE GALAXY, EXTRAGALACTIC OBJECTS AND SYSTEMS

74138 The Galaxy as fundamental calibrator of the extragalactic distance scale. I. The basic scale factors of the Galaxy and two kinematic tests of the long and short distance scales. G.de Vaucouleurs (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.451-67 (15 May 1983).
A new version of the oldest approach to estimating the distances of galaxies—direct comparison with the Galaxy—is proposed to relate the extragalactic distance scale to the basic metric, photometric, and kinematic scale factors of the Galaxy. These include the galactocentric distance of the Sun, the total magnitude of the Galaxy, and its spheroidal component, the galactic rotation velocity of the local standard of rest, the central velocity dispersion of the spheroidal component, and related parameters. (87 refs.)

74139 The Galaxy as fundamental calibrator of the extragalactic distance scale. II. Comparisons of metric and photometric scale lengths and three further tests of the long and short distance scales. G.de Vaucouleurs (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.468-75 (15 May 1983).
For pt.I see ibid., vol.268, no.2, pt.1, p.451-67 (1983). Metric and photometric parameters of the Galaxy are used to perform three further tests of the extragalactic distance scales. The validity of the Galaxy as a standard is discussed. The time scale argument often used as a prop to the long scale is shown to be inconclusive. (59 refs.)

74140 Monte Carlo simulations of the evolution of galactic nuclei containing massive, central black holes. M.J.Duncan, S.L.Shapiro (Center for Radiophys. & Space Res., Cornell Univ., Ithaca, NY, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.565-81 (15 May 1983).
A Monte Carlo scheme previously used to study the dynamical evolution of globular clusters is modified to simulate the evolution of dense galactic nuclei containing massive central black holes. The black hole is assumed to accrete the debris from stars which are either tidally disrupted by the hole or destroyed in direct physical collisions with other stars. The implications for quasar magnitudes and redshifts are briefly considered. (25 refs.)

74141 Star-burst galactic nuclei. V.A.Balzano (Dept. of Astron., Pennsylvania State Univ., University Park, PA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.602-27 (15 May 1983).
A survey of galaxies with star-burst nuclei was conducted to investigate their basic properties and to discover their relationship to other extragalactic objects. Spectrophotometric observations of 102 nuclei were obtained. These objects, which were primarily selected from the Markarian lists, have spectra characterized by strong, narrow, low-ionization emission lines. Their optical colors, emission-line properties, and radio continua can consistently be explained by the presence of young, hot star populations within these nuclei. Infrared J, H, and K magnitudes are now available for 50 star-burst nuclei. There is no correlation between the infrared and emission-line radiation from these objects. The near-infrared data, therefore, refers primarily to the older, cool star population. The space densities of this star-burst nuclei sample are tabulated as a function of $H\alpha$ luminosity. (88 refs.)

74142 Enhanced radio emission in merging galaxies. T.M.Heckman (Astron. Program, Univ. of Maryland, College Park, MD, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.628-31 (15 May 1983).
Selects examples of systems believed to represent mergers between spiral galaxies from the Arp, Atlas of Peculiar Galaxies. This sample of mergers is compared to two samples of spiral galaxies, in terms of radio power. The first comparison sample consists of galaxies with the same optical luminosities as the mergers. The second comparison sample is that subset of the first sample in which the galaxy is part of a double or multiple system. (25 refs.)

74143 The distribution of ionized gas in the nuclei of spiral galaxies. W.C.Keel (Lick Obs., Univ. of California, Santa Cruz, CA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.632-7 (15 May 1983).
Narrow-band digital images have been obtained for a sample of spiral galaxies selected to contain low-ionization emission regions in their nuclei. The images have been processed to yield pure $H\alpha+$[N II] images. These show that the optically emitting gas is usually concentrated in a nearly spherical core of half-intensity diameter typically 200 pc, often surrounded by a disk, in the galactic plane, traceable over a 600-900 pc diameter. This gas disk is not present in several cases in which it is expected by comparison with others of similar luminosity in emission, showing that some morphological variety exists among these emission regions. (24 refs.)

74144 Estimating the tumble rates of galaxy halos. G.F.Simonson (Yale Univ. Obs., New Haven, CT, USA), J.E.Tohline.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.638-45 (15 May 1983).
Shows that if a static spheroidal galaxy rigidly tumbles about a nonsymmetry axis, the preferred orientation of the gas can become a permanently and smoothly warped sheet, in which rings of gas at large radii may be fully orthogonal to those near the galaxy's core. Detailed numerical orbit calculations closely match an analytic prediction made previously for the structure of the warp. This structure depends primarily on the eccentricity, density profile and tumble rate of the spheroid. Two peculiar systems, NGC 5128 and NGC 2685, are examined. (18 refs.)

74145 Blue compact dwarf galaxies. II. Near-infrared studies and stellar populations. Trinh X. Thuan (Astron. Dept., Univ. of Virginia, Charlottesville, VA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.667-82 (15 May 1983).
For pt.I see ibid., vol.247, no.3, p.1, p.823-48 (1981). The results of an infrared photometric survey at J (1.2 μm), H (1.65 μm), and K (2.2 μm), of 36 blue compact dwarf galaxies (BCDG) where intense bursts of star formation are occurring, are presented. All galaxies were detected at a few mJy level. These near-infrared fluxes are probably due to an old population of K and M giants. BCDG follow a $J-K$ color-metallicity relationship similar to that for globular clusters. BCDG follow a well defined color-luminosity relationship suggesting that star formation processes in these galaxies are intimately linked to their total masses. (35 refs.)

74146 NGC 1275: a burgeoning elliptical galaxy. A.Wirth, S.J.Kenyon, D.A.Hunter (Dept. of Astron., Univ. of Illinois, Urbana, IL, USA).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.102-6 (1 June 1983).
Presents large-aperture spectrophotometry of the peculiar galaxy NGC 1275. Emission lines from $H\beta$, [O II], [O III], and [Ne III] dominate this spectrum, while $H\delta$, $H\varepsilon$ and Na D appear in absorption. A population synthesis model for the absorption-line spectrum suggests that $\sim$20% of the optical luminosity is produced by B stars. On the basis of this and the calculated $H\beta$ emission line flux the authors estimate the current star formation rate in NGC 1275. This leads to a predicted supernova rate of 1 yr^{-1}. The resulting supernovae heating rate is $\sim$one-half the cooling rate predicted by current accretion models and may thus significantly alter the accretion flow. The authors propose that in NGC 1275 we may be witnessing the formation of an elliptical galaxy in the cluster potential. (43 refs.)

74147 X-ray and optical studies of emission-line Markarian galaxies. J.S.Ulvestad (Nat. Radio Astron. Obs., Charlottesville, VA, USA), A.S.Wilson.
Astron. J. (USA), vol.88, no.3, p.253-9 (March 1983).
The X-ray and optical properties of a selection of compact nucleus, emission line Markarian galaxies have been studied. Observations with the Einstein Observatory have detected X-rays from all the Seyfert galaxies and none of the narrow emission line galaxies in the sample. This result supports the idea that powerful X-ray emission is correlated with the presence of a broad optical emission line component. The emission line spectra of the Seyfert galaxies show much higher excitation than do the narrow-line galaxies, whose spectra are similar to those of H II regions. Both the optical properties and the radio and X-ray upper limits of the non-Seyfert galaxies are consistent with the suggestion that those objects have undergone bursts of massive star formation. (38 refs.)

74148 Sensitive mapping of E and S0 galaxies in search of H I content differences between supernovae and nonsupernovae producing galaxies. C.K.Kumar (Dept. of Phys., & Astron., Howard Univ., Washington, DC, USA), N.Thonnard.
Astron. J. (USA), vol.88, no.3, p.260-6 (March 1983).
Thirteen elliptical and S0 galaxies in the Virgo and Pegasus I clusters have been mapped over their optical extent in the 21-cm neutral hydrogen line with the 305-m Arecibo telescope. No neutral hydrogen was detected in any of the galaxies, including NGC 4636, which had previously been reported as containing H I. New upper limits to the H I content of these galaxies ($\sim 5\times 10^7$ $M_\odot$ in Virgo) are presented. The authors discuss their implications for the origin of Type I supernovae and the mechanisms for gas removal from elliptical galaxies. (29 refs.)

74149 Neutral hydrogen in isolated galaxies. II. The large angular diameter galaxies. J.N.Hewitt (Dept. of Phys., MIT, Cambridge, MA, USA), M.P.Haynes, R.Giovanelli.
Astron. J. (USA), vol.88, no.3, p.272-95 (March 1983).
For pt.I see Astrophys. J. Lett. Ed., vol.240, no.2, p.L87-91 (1980). Fifty-two of the large angular diameter ($a\geq 2.5'$) galaxies included in the 21-cm survey of isolated galaxies being undertaken at Arecibo by Haynes and Giovanelli have been mapped along their optical major axes using the 305-m telescope and the low sidelobe flat feed system. The observed fluxes have then been compared with a numerical convolution of an assumed H I distribution $\sigma_H(r)$ and the beam pattern $G(\theta)$ to produce an estimate of the characteristic size. The derived H I scale length R_{70} is that radius interior to which 70% of the model's H I mass is contained. With still a significant scatter, the H I diameter $D_{70}=2R_{70}$ is on the average about 1.2 times the UGC blue diameter a, and shows no dependence on morphological type for types later than Sa. Application of the observed relationship between H I size and optical diameter and of an assumed double Gaussian (centrally depressed) H I surface density distribution produces proper corrections for source to beam size. Corrected fluxes derived from Arecibo data do not differ systematically from those measured at the 91-m telescope, proving the applicability of the calibration and correction procedure. The H I mass M_H is shown to be nearly proportional to the square of the linear H I diameter, implying that the H I surface density averaged over the disk is almost constant. (24 refs.)

74150 A color-magnitude diagram for Leo II. S.Demers (Univ. de Montreal, Montreal, Quebec, Canada), W.E.Harris.
Astron. J. (USA), vol.88, no.3, p.329-37 (March 1983).
For the dwarf spheroidal galaxy Leo II, the authors present a color-magnitude diagram to $V_{\mathrm{lim}}\simeq 22$, derived from CFHT prime focus plates.The CMD reveals a moderately wide red giant branch with its brightest stars at $V\simeq 19.4$, $(B-V)\simeq 1.8$, similar in morphology to the giant branch of Fornax. From the magnitude level of the giants, the authors estimate that Leo II is (230 ± 20) kpc distant, far enough that its physical association with our galaxy may be questioned. Star counts made from the deepest B plate show that the surface density profile of Leo II is well matched by a King model with $\log(r_t/r_c)=0.5$ and $r_t=10.7'$. (27 refs.)

74151 Globular cluster orbits and the galactic mass distribution. K.A.Innanen (Phys. Dept., York Univ., Toronto, Ontario, Canada), W.E.Harris, R.F.Webbink.
Astron. J. (USA), vol.88, no.3, p.338-60 (March 1983).
Investigates both the shapes of typical globular cluster orbits and the distribution of galactic mass with distance, using the globular cluster tidal radii as probes of the galactic gravitational field at their perigalactic points. Starting from the way in which cluster energies and angular momenta interact with the galactic potential, the authors discuss the relationship between the cluster tidal radius and its perigalactic distance, as well as the expected distribution of tidally limited cluster densities. By then comparing the observed cluster radii and densities, the authors draw the following conclusions: (1) Random measurement errors (particularly of the observed tidal radii) are so large that individual estimates of cluster perigalactic are largely meaningless. (2) If one assumes a typical globular cluster mass-to-light $(m/l)_V=1.7$, the resulting shapes of the cluster orbits implied by their tidal radii are too nearly circular to be consistent with their velocity dispersions. Instead, an m/l ratio two or three times higher is needed to make their orbital properties agree with those deduced from their radial velocities. (3) The intrinsic dispersion in cluster mean densities at a given galactocentric distance is small enough to preclude any clusters having highly elongated orbits (i.e. low dimensionless angular momenta). The globular clusters must therefore have a toroidal, rather than spheroidal, distribution in velocity space, with the axis pointed toward the galactic center. (4) There is little change in the dispersion of cluster densities with galactocentric distance, indicating that radial trends in the kinematics of the cluster system are small. (54 refs.)

74152 Redshifts for 115 galaxies near the equator. S.A.Shectman (Mount Wilson & Las Campanas Obs., Pasadena, CA, USA), R.P.Stefanik, D.W.Latham.
Astron. J. (USA), vol.88, no.4, p.477-82 (April 1983).
The authors report new redshifts for 115 bright galaxies located near the celestial equator. The spectra were observed with a blue-sensitive photon-

counting Reticon on the 100-in DuPont telescope, and the redshifts were derived using the data-analysis system developed for the CfA Redshift Survey. Comparisons with other measured redshifts suggest that these data are similar in quality to the redshifts measured at Mt. Hopkins for the CfA Redshift Survey; the velocity zero point is good to 10 or 15 km s^{-1}, with a typical error of 35 km s^{-1} for the individual measurements. (13 refs.)

74153 On the evolution of the spiral galaxies in the Virgo cluster. R.C.Kennicutt,Jr. (Dept. of Astron., Univ. of Minnesota, Minneapolis, MN, USA).
Astron. J. (USA), vol.88, no.4, p.483-8 (April 1983).
Integrated Balmer emission line fluxes have been measured for 26 spiral galaxies in the core of the Virgo cluster. They are combined with published 21-cm and *UBV* color data in order to compare the disk properties of the cluster galaxies with galaxies in the field. Virgo spirals of a given Hubble type possess less star formation, less neutral hydrogen, and are redder than their field counterparts. Various possible selection effects are examined, but they cannot explain the differences. The relationships between color, $M_{\rm H}/L$ and Hα strengths, however, are indistinguishable in Virgo and the field. Some of the Virgo spirals may simply be normal spirals of slightly earlier type, but at least a few appear to be genuinely anemic galaxies, as suggested by van den Bergh. (17 refs.)

74154 21-cm observations of galaxies in groups and multiplets. J.W.Sulentic (Dept. of Phys. & Astron., Univ. of Alabama, University, AL, USA), H.Arp.
Astron. J. (USA), vol.88, no.4, p.489-506 (April 1983).
Measures at the 21-cm line of neutral hydrogen are reported for a large sample of individual galaxies in groups as well as for interacting multiple-component systems. The observations of single galaxies were designed to study differential redshifts within groups. Observations of interating systems were undertaken to obtain system redshifts as well as 21-cm profile morphology. The data, which will be used in future analyses, are presented here along with a discussion of interaction morphology from the 21-cm profile point of view. Together the profile samples encompass the full range of dynamical states in which the gas components of galaxies are observed, from relaxed to violently disrupted. (29 refs.)

74155 Photometry of Cepheids in the LMC and Magellanic Cloud abundances. H.C.Harris (Dominion Astrophys. Obs., Herzberg Inst. of Astrophys., Victoria, British Columbia, Canada).
Astron. J. (USA), vol.88, no.4, p.507-17 (April 1983).
Washington-system colors of 40 Cepheids in the Large Magellanic Cloud are used to study the metal abundances within the LMC and to compare with abundances in the SMC and the Galaxy. The LMC Cepheids are quite homogeneous: they show a dispersion in observed $[A/H]$ of ± 0.14, probably due to a width for the instability strip of about $0.07^{\rm m}$ in T_1-T_2 (about 400K) combined with a real dispersion in $[A/H]$ of ± 0.1. Neither they nor SMC Cepheids show the correlation of residuals from the $P-L$ relation with abundance which has been predicted based on evolutionary models. The values of reddening found within the LMC are weakly correlated with H I column density, and are sufficiently small [mean $E(T_1-T_2)=0.04^{\rm m}$] that the derived dust/gas ratio in the LMC is 0.4 times that in the Galaxy. No gradient in abundances within the LMC is found, either with east-west position or radially. It is suggested that variations both in the B/R ratio of supergiants and in the mean periods of Cepheids across the LMC might be better explained by variations in the rate of star formation rather than by abundance variations. The abundances of the LMC and SMC Cepheids relative to Galactic Cepheids are found to be -0.09 and -0.65, respectively, and are compared with results from other studies. (44 refs.)

74156 NGC 4151. H.Schulz, J.Fried, H.Hippelein.
I.A.U. Circ. (USA), no.3813, 1 pp. (18 May 1983).
It is reported that a pronounced narrow depression appeared in the blue wing of broad-line Hα in the Seyfert galaxy NGC 4151 in a 5-minute reticon spectrum taken on 1983 March 30. The presence of this feature is confirmed by a photographic image-tube spectrum taken on May 3, although the broad emission wings may have become stronger in the meantime. The feature is probably related to the transient blueshifted Balmer absorption detected by Anderson and Kraft (1969). (2 refs.)

74157 Intergalactic shock waves. V.V.Chernomordik, L.M.Ozernoy (Dept. of Theoretical Phys., Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Nature (GB), vol.303, no.5913, p.153-5 (12 May 1983).
Young galaxies as well as quasars and active galactic nuclei, have long been considered as possible sources of shock waves entering the intergalactic medium. Following convincing evidence that the narrow absorption lines seen shortward of the Lyα emission line in very distant quasars are mostly intervening (and not intrinsic) Lyα absorption lines, various attempts have been made to relate the cold H I absorbers (in part, at least) with actual shock waves in the intergalactic medium. The authors consider intergalactic shocks in a low density universe when energy losses from shocks are negligible at the redshifts of interest. However, even at this essentially adiabatic evolution stage, the absorption of the outer radiation in the outermost densest and coldest regions of the shock waves is capable of producing measurable Lyα absorption lines. Moreover, these lines should be observed, due to a specific geometry, in the form of special 'doublets'. The authors demonstrate that there are such doublets in quasar spectra among the Lyα 'forest', and this can apparently be regarded as the first conclusive evidence in favour of intergalactic shock waves. (17 refs.)

74158 Optical polarization position angle versus radio structure axis in Seyfert galaxies. R.R.J.Antonucci (Nat. Radio Astron. Obs., Charlottesville, VA, USA).
Nature (GB), vol.303, no.5913, p.158-9 (12 May 1983).
Optical polarization position angles tend to align with large-scale radio structure in low polarization quasars, and they tend to align with or be perpendicular to the radio structure in radio galaxies. In some cases active object emission lines are polarized like the continuum, so the polarization is probably caused by scattering. Thus, the polarization alignments indicate the geometrical distribution of scatterers in those cases and so provide information on the matter distribution in the innermost regions. In a new interpretation of the Seyfert 2 galaxy NGC 1068, it is noted that the optical polarization of that object is perpendicular to the inner radio contours, while the polarization of the Seyfert 1 galaxy NGC4151 is parallel to the associated radio axis. It is speculated that these are prototypical of two polarization classes of Seyferts analogous to the perpendicular and parallel radio galaxy groups. He shows here that this is indeed the case: all Seyfert 1 galaxies in this sample have roughly parallel polarization and all Seyfert 2 galaxies have roughly perpendicular polarizations. These alignment effects can be interpreted as being due to thin and thick scattering disks, respectively, surrounding the continuum sources. This would represent a fundamental difference between the two types of Seyfert galaxies. (16 refs.)

Decay of long-lived particles in the early Universe ....See Entry 73985

Relativistic thermal plasmas: effects of magnetic fields ....See Entry 73986

Effects of the Kelvin-Helmholtz surface instability on supersonic jets ....See Entry 73987

Magnetic fields in astrophysics ....See Entry 73988

An atlas of H II regions in 125 galaxies ....See Entry 74000

The Asiago Catalogue of Quasi Stellar Objects ....See Entry 74001

The minimum period and the gap in periods of cataclysmic binaries ....See Entry 74073

Variable F-type supergiants far above the galactic plane ....See Entry 74082

Possible supernova in NGC 4258 ....See Entry 74093

Supernovae ....See Entry 74094

Temperature dependent gravitational constant and black hole physics ....See Entry 74102

On the equilibrium configurations of prolate, axisymmetric stellar systems ....See Entry 74119

Interstellar Hα emission along the galactic equator ....See Entry 74124

Magellanic Cloud planetary nebula with suspected strong forbidden iron lines ....See Entry 74136

CCD photometry of Abell clusters. II. Surface photometry of 249 cluster galaxies ....See Entry 74159

Effects of galaxy collisions on the structure and evolution of galaxy clusters. I. Mass and luminosity functions and background light ....See Entry 74160

Redshift modifications to *HEAO* A-1 cluster X-ray luminosities ....See Entry 74161

21 centimeter observations of supercluster galaxies: the bridge between Coma and A1367 ....See Entry 74164

CO observations of the galaxies in the Leo triplet: NGC 3623, NGC 3267, and NGC 3628 ....See Entry 74165

Observations of low redshift H I in Stephan's Quitent ....See Entry 74166

Pressure collimation of supersonic radio jets ....See Entry 74167

Reddening indicators for quasars and Seyfert 1 galaxies ....See Entry 74170

On the association of galaxies and QSOs ....See Entry 74171

Analysis of complete quasar samples to obtain parameters of luminosity and evolution functions ....See Entry 74172

Quasar evolution and gravitational collapse ....See Entry 74174

A new test of the cosmological interpretation of QSO redshifts ....See Entry 74177

Discovery of DHM0054−284, a quasar of redshift 3.61 ....See Entry 74178

Distribution of QSOs around NGC 1097 ....See Entry 74179

Stellar contributions to the hard X-ray galactic ridge ....See Entry 74181

Solrad 11 observations of the far-ultraviolet background ....See Entry 74183

Formation of structure in an axion-dominated Universe ....See Entry 74194

98.50K Groups, clusters, superclusters

74159 CCD photometry of Abell clusters. II. Surface photometry of 249 cluster galaxies. D.P.Schneider (Palomar Obs., California Inst. of Technol., Pasadena, CA, USA), J.E.Gunn, J.G.Hoessel.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.476-94 (15 May 1983).
For pt.I see ibid., vol.264, no.2, pt.1, p.337-55 (1983). Presents CCD surface photometry of the brightest three galaxies in the cores of 83 Abell clusters. The 1 σ dispersions in the absolute magnitudes for the first, second, and third ranked cluster galaxies (G1, G2, and G3) are 0.35, 0.55, and 0.65, respectively. The luminosities of G1, G2, and G3 all rise with increasing Abell richness class, but the magnitude difference between them remains roughly the same. The magnitude of G1 is quite sensitive to Bautz-Morgan (BM) class, but there seems to be little relation between BM type and the magnitudes or structure of G2 and G3. The colors of all three are very similar and show no signs of evolution back to redshifts of 0.25. (38 refs.)

74160 Effects of galaxy collisions on the structure and evolution of galaxy clusters. I. Mass and luminosity functions and background light. G.E.Miller (Dept. of Astron., Univ. of Virginia, Charlottesville, VA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.495-512 (15 May 1983).
The role of galaxy collisions in controlling the form of the galaxy mass and luminosity functions and in creating a diffuse background light is investigated by means of a direct computer simulation. Galaxy collisions are treated in a realistic manner, including both galaxy mergers and tidal encounters. A large number of theoretical studies of galaxy collisions were consulted to formulate the basic input physics of collision cross sections. Despite this large number of studies, there remains considerable uncertainty in the effects of a collision on a galaxy due mainly to the lack of knowledge of the orbital distribution of matter in galaxies. To improve this situation, some methods of semiempirical calibration are suggested—for example, a survey of background light in clusters of different richness and morphological classes. (82 refs.)

74161 Redshift modifications to *HEAO* A-1 cluster X-ray luminosities. M.P.Kowalski, M.P.Ulmer (Northwestern Univ., Evanston, IL, USA), R.G.Cruddace.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.540-51 (15 May 1983).
Spectroscopic redshifts are determined for several of the Abell clusters in the *HEAO* A-1 X-ray catalog. These data are used along with other redshift data to derive revised luminosity functions. A systematic difference between the authors' measured redshifts and estimated redshifts is determined. Redshift corrections to all other clusters in the X-ray catalog are produced to examine the effect of such estimates. Luminosity functions are also created over different distance ranges to search for cluster evolution. Four analytic expressions (exponential, power-law, exponential times power-law, and double power-law) are fitted to all luminosity functions. (23 refs.)

74162 Accretion-driven star formation in central dominant galaxies in X-ray clusters. C.L.Sarazin (Dept. of Astron., Univ. of Virginia, Charlottesville, VA, USA), R.W.O'Connell.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.552-60 (15 May 1983).
Argues that low-mass stars are being formed from the large amounts of gas being accreted by central dominant galaxies in some X-ray clusters. Low-mass star formation may be favored because the Jeans mass decreases as the ambient pressure increases, and the pressures observed in these accretion flows are four orders of magnitude higher than those in the local interstellar medium. The authors calculate the spectra for the inner parts of these galaxies including accretion-driven star formation, and show that the colors of

these galaxies may be affected at an observable level. The authors suggest observations to search for these color anomalies. (55 refs.)

74163 A note on the formation of clusters of galaxies. P.S.Wesson (Dept. of Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.561-4 (15 May 1983).
Perturbations of a previously given exact, inhomogeneous solution of Einstein's equations are considered as a model for the formation of a cluster of galaxies. It is shown that during the collapse of a cluster, it maintains its smooth density profile over most of its extent. (20 refs.)

74164 21 centimeter observations of supercluster galaxies: the bridge between Coma and A1367. G.L.Chincarini (Univ. of Oklahoma, Norman, OK, USA), R.Giovanelli, M.P.Haynes.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.13-28 (1 June 1983).
Presents 21 cm observations of galaxies in the region of the Coma-A1367 supercluster. It is shown that galaxies near the cluster centers are hydrogen deficient while galaxies which are in between the two clusters have a normal hydrogen content. A crossing time of about 1.7×10^9 yr is defined by the radius of the region of transition between deficient and nondeficient galaxies and the cluster's velocity dispersion. The gas removed by stripping is a small fraction of the gas observed in the X-ray region. (40 refs.)

74165 CO observations of the galaxies in the Leo triplet: NGC 3623, NGC 3267, and NGC 3628. J.S.Young, L.J.Tacconi, N.Z.Scoville (Five College Radio Astron. Obs., Univ. of Massachusetts, Amherst, MA, USA).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.136-46 (1 June 1983).
Observations of the 2.6 mm CO line in the three interacting galaxies of the Leo triplet, made with the 14 m FCRAO telescope (HPBW=50″), are presented. Since the galaxies are all at the same distance, their relative CO contents are determined with no ambiguity—allowing a direct comparison of the masses of molecular gas over a range of Hubble types. The results indicate that the tical interaction of the galaxies has not greatly affected the star forming efficiency. (31 refs.)

74166 Observations of low redshift H I in Stephan's Quitent. J.W.Sulentic (Univ. of Alabama, University, AL, USA), H.Arp.
Astron. J. (USA), vol.88, no.3, p.267-71 (March 1983).
Neutral hydrogen measures that cover the velocity range from $V=200$ to 2200 km s^{-1} are reported for Stephan's Quitent and its immediate vicinity. All measures were obtained using a new very sensitive cooled GaAsFet receiver and the 305^m reflector at Arecibo. The observations indicate the existence of low redshift H I which is significantly displaced from the position of the low redshift optical component of the Quintet, NGC 7320. Analysis of previous measures of the Sd galaxy NGC 7320 show that it is strongly H I deficient for its type and also deficient in the fraction of its mass in the form of H I. Both results could be attributed to removal of H I from HGC 7320 by interaction, possibly with the high redshift members of the Quintet. This possibility justifies remeasurement of the H I around NGC 7320 with the highest sensitivity and resolution available. (14 refs.)

On the evolution of the spiral galaxies in the Virgo cluster .....See Entry 74153
21-cm observations of galaxies in groups and multiplets ....See Entry 74154
On the association of galaxies and QSOs ....See Entry 74171
Spherical simulations of holes and honeycombs in Friedmann universes ....See Entry 74186

98.70 OTHER OBJECTS AND BACKGROUND RADIATIONS OF UNKNOWN ORIGIN AND DISTANCES

(for pulsars, see 97.60G)

98.70D Discrete radio sources

74167 Pressure collimation of supersonic radio jets. A.Krautter, R.N.Henriksen, K.Lake (Dept. of Phys., Queen's Univ. of Kingston, Kingston, Ontario, Canada).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.81-93 (1 June 1983).
The transversely homologous steady state models of radio jets are treated as three-component mixtures (protons, electrons, and relativistic electrons). The jets may be both relativistically hot and macroscopically relativistic. The authors find a new fit for the main jet in NGC 315 with a model dominated by relativistic-electron pressure and demonstrate an alternative method for deducing the external equilibrium pressure requred to collimate a jet. This new method does not require an a priori parameterized pressure law to be assumed. The authors also discuss the maximum 'curvature' which a homologous, pressure-confined jet may have, and so deduce distinguishing behavior of macroscopically relativistic jets and of cold jets. (24 refs.)

74168 Rotation measures for compact variable radio sources. L.Rudnick, T.W.Jones (Dept. of Astron., Univ. of Minnesota, Minneapolis, MN, USA).
Astron. J. (USA), vol.88, no.4, p.518-26 (April 1983).
The authors have derived rotation measures for 31 compact variable extragalactic sources using Very Large Array observations at λ 18 cm and λ 20.5 cm. Polarization and total intensity data are presented for these and 29 additional soures at λ6 cm and λ 2 cm as well. Maps are also presented for sources with confusing extended structure. The calculated rotation measures are distributed similarly to those of extended sources, and do not appear to change over ~7 years (using data from Wardle 1977). The intrinsic polarization position angles of compact sources are shown to be similar over wide separations in wavelength. The authors briefly discuss the implications for the magnetic fields in and around compact sources. (10 refs.)

Transfer of polarized radiation in astronomical masers .... See Entry 73982
Effects of the Kelvin-Helmholtz surface instability on supersonic jets ....See Entry 73987
Magnetic fields in astrophysics ....See Entry 73988
The environment of T Tauri stars .... See Entry 74066
The dust around the carbon star IRC+10216 ....See Entry 74074
Possible supernova in NGC 4258 .... See Entry 74093
The period history of the X-ray pulsar in MSH 15−52 ....See Entry 74096
First observations of stellar coronal structure: the coronae of AR Lacertae ....See Entry 74107
Warm H I halos around molecular clouds ....See Entry 74126
Stellar winds and molecular clouds: T Tauri stars .... See Entry 74127
MSH 15−52: a supernova remnant containing two compact X-ray sources ....See Entry 74128
Enhanced radio emission in merging galaxies ....See Entry 74142
NGC 1275: a burgeoning elliptical galaxy ....See Entry 74146
21-cm observations of galaxies in groups and multiplets ....See Entry 74154
Optical polarization position angle versus radio structure axis in Seyfert galaxies ....See Entry 74158

98.70J Quasars

74169 The ultraviolet excess of luminous quasars. II. Evidence for massive accretion disks. M.A.Malkan (Palomar Obs., California Inst. of Technol., Pasadena, CA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.582-90 (15 May 1983).
For pt.I see ibid., vol.254, no.1, pt.1, p.22-37 (1982). Presents new infrared, optical, and ultraviolet spectra of three high-redshift quasars. They are analyzed along with three published quasar spectra. After accounting for other sources of radiation, the continua are fitted with spectra predicted for optically thick steady-state accretion disks which include the effects of general relativity. The two fitting parameters, the mass of the accreting black hole and the accretion rate, are determined by the data with a formal accuracy of 20%. (29 refs.)

74170 Reddening indicators for quasars and Seyfert 1 galaxies. S.A.Grandi (Dept. of Astron., Univ. of California, Los Angeles, CA, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.591-601 (15 May 1983).
Various techniques used to measure the dust reddening (exterior to the Milky Way) toward the broad line emission clouds of quasars and Seyfert 1 galaxies are critically analyzed. Detailed measurements of the UV and optical emission lines in the spectra of the bright Seyfert 1 galaxies Markarian 335 and 817 are presented. (66 refs.)

74171 On the association of galaxies and QSOs. H.B.French (Dept. of Phys. & Astron., Univ. of Oklahoma, Norman, OK, USA), J.E.Gunn.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.29-34 (1 June 1983).
It is found from galaxy counts that there is a strong tendency for galaxies at about the plate limit of the 1.2 m Palomer Schmidt telescope to cluster about low-redshift QSOs. The signifiance of this clustering has been estimated in a nonparametric way using the Komogorov-Smirnov test and is found to be significant at the 99% level. If a power-law form for the galaxy-QSO cross-correlation function is assumed, the amplitude is the same within the errors to that of the galaxy-galaxy autocorrelation function. (26 refs.)

74172 Analysis of complete quasar samples to obtain parameters of luminosity and evolution functions. H.L.Marshall, Y.Avni, H.Tanabaum, G.Zamorani (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.35-41 (1 June 1983).
Presents a parametric likelihood analysis of the joint redshift-luminosity distribution for a composite, complete sample of 32 quasars with $17.0<B<19.2$ selected on the basis of ultraviolet excess. The authors determine best estimates and joint confidence regions for the parameters of several models of the quasar optical luminosity and evolution function. These models are also tested explicitly for their acceptability. The authors reject a model invoking pure density evolution on the basis of its extrapolation to fainter magnitudes through comparisons with the optical number counts and independently with the observed 2 keV X-ray background. The authors discuss the contribution of quasars to the X-ray background at 2 keV. (15 refs.)

74173 Optical and X-ray observations of faint quasars in an optically selected sample. H.L.Marshall, H.Tananbaum, G.Zamorani, J.P.Huchra (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA), A.Braccesi, V.Zitelli.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.42-8 (1 June 1983).
Reports on spectroscopic and X-ray observations of quasar candidates in the 1.72 deg^2 region centered on $17^h.6°$, as selected by Formiggini et al (1980) on the basis of ultraviolet excess. The athors confirm six more quasars using spectroscopic data obtained with the MMT, producing a complete sample of 10 quasars having a limiting B magnitude of 19.20 The integral surface density of UV excess quasars at this magnitude is found. The authors complete the identification of quasar candidates with $B<18.25$ in the 37.2 deg^2 sample (from Braccesi, Formiggini, and Gandolfi, 1970) and find the surface density of quasars with $B<18.25$. X-ray data for these 10 quasars, from the Einstein Observatory, allow one to estimate the contribution of quasars with $B<19.20$ and $z<2.2$ to the cosmic 2 keV background. (24 refs.)

74174 Quasar evolution and gravitational collapse. A.Cavaliere (Istituto Astron., Univ. di Roma, Roma, Italy), E.Giallongo, A.Messina, F.Vagnetti.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.57-72 (1 June 1983).
Presents three convergent results concerning the sources in the active nuclei of quasars and radio galaxies that derive their power from conversion of gravitational energy. The authors derive, for several leading models based on liberation of gravitational energy from mass in a compact supply, the laws governing the secular change $\dot{L}$ of the primary power driving the individual sources, and identify their common and key property. The authors describe a general statistical framework to populate with sources the (luminosity, cosmic time)-plane, based on a continuity equation that embodies a given $\dot{L}$. With $\dot{L}$ derived, the authors obtain basic evolutions of the density ($\dot{L}>0$) and of the luminosity ($\dot{L}<o$) type, with a global difference character. Finally, the authors compute the full evolution functions, comprising a brightening ($\dot{L}>0$) and a dimming ($\dot{L}<0$) phase, corresponding to three such models. (54 refs.)

74175 Spectroscopy of variable blue stellar objects. P.D.Usher, A.Warnock,III (Dept. of Astron., Pennsylvania State Univ., University Park, PA, USA), R.F.Green.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.73-80 (1 June 1983).
Reports spectroscopic identifications of 23 ultraviolet-excess objects from three Palomar Schmidt fields at high galactic latitude centered on Kapteyn Selected Areas 57, 29, and 28. Twenty-one of the objects were selected on the basis of apparent optical variability; of these, 14 were found to be quasars, and one is a cataclysmic variable. The redshift distribution of high-amplitude variables is consistent with that predicted for the parent population but might suggest a higher likelihood for variability in higher luminosity objects. Evidence is presented in support of a conclusion, that between 7 and 11 quasars are variable with extremum amplitudes $\Delta B\geq0.5$ mag to $B=19$ mag over 22 deg^2 of sky, with a time coverage comprised of one archival Palomar Observatory Sky Survey plate and several contemporary plates. The discovery rate of quasars and variable stars will be greater for techniques with a high signal-to-noise ratio and sampling rate. The result suggests that most optically selected quasars are detectably variable. (30 refs.)

74176 Rectilinear motions in 3C 345. M.H.Cohen, S.C.Unwin, T.J.Pearson, G.A.Seielstad, R.S.Simon (Owens Valley Radio Obs., California Inst. of Technol., Pasadena, CA, USA), R.P.Linfield, R.C.Walker.
Astrophys. J. Lett. Ed. (USA), vol.269, no.1, pt.2, p.L1-4 (1 June 1983).
In 3C 345 a position angle coincidence between the elongation seen in 1971-1975 at 1-15 milli-arcsec from the core, and the outer component seen in 1978-1981 at 3.5-5 milli-arcsec, provides evidence for rectilinear motion. The inner component seen in 1978-1981 at 1-2 milli-arcsec is at a different

position angle. The observed curvature appears to be caused by a change in orientation of the nozzle, and not by components following a fixed curved path. The outer component seen in 1978-1981 is identified with the 1971-1975 western component, and this implies a linear acceleration in 1974-1976. (20 refs.)

74177 A new test of the cosmological interpretation of QSO redshifts. P.A.Shaver (European Southern Obs., Garching bei Munchen, Germany), J.G.Robertson.
Nature (GB), vol.303, no.5913, p.155-6 (12 May 1983).
Close QSO pairs can be used to test the cosmological interpretation of QSO redshifts. If (some of) the narrow absorption lines in QSO spectra arise in intervening matter, and if QSOs are surrounded by gaseous haloes or located in regions of high matter density (for example, clusters of galaxies), one may expect to find absorption in the spectrum of one QSO at the redshift of a foreground QSO which happens to be located nearby on the plane of the sky ('associated absorption'). According to the cosmological interpretation, the foreground QSO should have the lower redshift. If, on the other hand, QSO redshifts are unrelated to their distances, one would expect to find as many cases in which the foreground QSO has the higher redshift of the two; or if the absorption lines are not even due to intervening matter, there should be no coincidences of absorption and emission redshifts beyond random expectation. Thus, using associated absorption to distinguish which QSO of a pair is in front of the other provides a simple and straightforward test of the cosmological interpretation. (8 refs.)

74178 Discovery of DHM0054−284, a quasar of redshift 3.61. T.Shanks, R.Fong, B.J.Boyle (Dept. of Phys., Univ. of Durham, Durham, England).
Nature (GB), vol.303, no.5913, p.156-8 (12 May 1983).
The authors report the discovery of a quasar of redshift 3.61 detected in a broad band survey of stars using COSMOS measurements of UK Schmidt Telescope (UKST) photographs. The identification of the object as a quasar was confirmed by spectroscopic observations made with the Anglo-Australian Telescope (AAT). The quasar's redshift is the second highest so far detected and the highest for a quasar discovered using purely optical techniques. The authors describe the search for DHM0054−284 and suggest that the methods provide an efficient way of finding more high-redshift quasars. (9 refs.)

74179 Distribution of QSOs around NGC 1097. He Xiangtao, R.D.Wolstencroft (Royal Obs., Edinburgh, Scotland).
Sci. Sin. (China), vol.26, no.4, p.418-27 (April 1983).
The UK 1.2 m Shmidt telescope was used to obtain two objective-prism plates and one direct plate of the area around NGC 1097, centred on $2^h44.2^m-30°29.0'$ (1950.0) 37 quasar candidates are found within a 9 square degree region. Adding 6 QSOs found before, the total number of QSOs found in this area is 43. The authors have analysed the distribution of the QSOs around NGC 1097. The preliminary results are as follows: (i) The surface density of QSOs is very high near NGC 1097 and decreases with distance, from 15.2 to 2.0 per square degree. The average density is about 4.8 per square degree. (ii) There is an obvious correlation between the jets and the QSOs. (iii) It is difficult to explain the distribution of the QSOs by accidental probability or other reasons. This is good evidence to suggest that the redshifts are non-cosmological. (21 refs.)

Relativistic thermal plasmas: effects of magnetic fields .... See Entry 73986
The Asiago Catalogue of Quasi Stellar Objects .... See Entry 74001
Intergalactic shock waves .... See Entry 74157
Solrad 11 observations of the far-ultraviolet background .... See Entry 74183

98.70L IR sources

(see also 98.40 in nebulae)

The environment of T Tauri stars .... See Entry 74066
The dust around the carbon star IRC+10216 .... See Entry 74074
Variable F-type supergiants far above the galactic plane .... See Entry 74082
Infrared light curves of Type I supernovae. II. Late stages .... See Entry 74090

98.70Q X-ray and gamma-ray sources

74180 The central X-ray source in RCW 103: evidence for blackbody emission. I.R.Tuohy (Mount Stromlo & Siding Spring Obs. Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia), G.P.Garmire, R.N.Manchester, M.A.Dopita.
Astrophys. J. (USA), vol.268, no.2, pt.1, p.778-81 (15 May 1983).
The authors present an improved position for the compact X-ray source in the center of the young supernova remnant RCW 103. Only one star brighter than $V\sim22$ mag lies inside the new error circle, but a spectroscopic study of the star rules out any relationship to the X-ray source. A sensitive search for radio pulsations from RCW 103 has proved equally unsuccessful. The absence of an optical or radio counterpart for the central X-ray source strengthens the likelihood that the object is a hot neutron star emitting blackbody radiation. This result is in accord with several theoretical calculations of neutron star cooling rates. (32 refs.)

74181 Stellar contributions to the hard X-ray galactic ridge. D.M.Worrall (Center for Astrophys. & Space Sci., Univ. of California, San Diego, CA, USA), F.E.Marshall.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.691-7 (15 April 1983).
Compares the number density of serendipitous sources in galactic plane Einstein Observatory IPC fields with predictions based on the intensity of the HEAO 1 A-2 unresolved hard X-ray galactic ridge emission. The authors conclude that theoretically predicted X-ray source populations of luminosity (8×10^{32})-(3×10^{34}) ergs s^{-1} have 2-10 keV local surface densities of less than $\sim8\times10^{-4}\ L_{32}{}^{-1}\ pc^{-2}$ and are unlikely to be the dominant contributors to the hard X-ray ridge. A new estimate for Be/neutron star binary systems, such as X Persei, which are in this luminosity range and were previously thought to be potentially large X-ray ridge contributors, gives a 2-10 keV local surface density of $\sim2.6\times10^{-5}\ L_{32}{}^{-1}\ pc^{-2}$. (30 refs.)

74182 Einstein observations of the rho Ophiuchi dark cloud. An X-ray Christmas tree. T.Montmerle, L.Koch-Miramond (Section d'Astrophys., CEN, Gif-sur-Yvette, France), J.E.Grindlay.
Astrophys. J. (USA), vol.269, no.1, pt.1, p.182-201 (1 June 1983).
An extensive guest observation of the ρ Ophiuchi dark cloud region was conducted with the Einstein Observatory, featuring in particular repeated observations of several parts of the cloud, on time scales down to a deay, or even hours. In all, 14 IPC and 3 HRI fields were obtained. Initially motivated by a search for a possible compact counterpart to the *COS B* γ-ray source 2CG 353+16 (for which no evidence was found), the present study gave a wealth of data, which turned out to be mostly relevant to early stages of stellar evolution. The authors interpret the time variability in terms of strong stellar flares, which dominate the X-ray luminosity of the sources. The authors discuss several implications bearing on early stages of stellar evolution and some consequences of the presence of X-ray active objects within dark clouds. Several comparisons are made with the Orion complex. Possible observational tests are suggested. (78 refs.)

The Asiago Catalogue of Quasi Stellar Objects .... See Entry 74001
A search for weak Hα emission line pre-main-sequence stars .... See Entry 74069
The period history of the X-ray pulsar in MSH 15−52 .... See Entry 74096
First observations of stellar coronal structure: the coronae of AR Lacertae .... See Entry 74107
MSH 15−52: a supernova remnant containing two compact X-ray sources .... See Entry 74128
X-ray and optical studies of emission-line Markarian galaxies .... See Entry 74147
Redshift modifications to *HEAO* A-1 cluster X-ray luminosities .... See Entry 74161
Accretion-driven star formation in central dominant galaxies in X-ray clusters .... See Entry 74162

98.70V Background radiations

74183 Solrad 11 observations of the far-ultraviolet background. C.S.Weller (Naval Res. Lab., Washington, DC, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.899-904 (15 May 1983).
Far-ultraviolet observations from the Solrad 11 satellite have established intensities of the 1220-1500 Å far-ultraviolet diffuse background of 180 and 280 photons $s^{-1}\ cm^{-2}\ sr^{-1}\ Å^{-1}$ near the north and south galactic poles, respectively. Compared with these intensities, other reported measurements range from near agreement to several times greater. This variation probably results from spurious effects on the diffuse background measurement such as airglow, energetic particles, and instrumental background. For the present measurements, however, no corrections for instrumental or atmospheric effects are required. Calculated direct starlight is a correction of ~25% to the total observed flux. Scattering from interstellar grains probably accounts for only a few percent of the diffuse background; estimates of the integrated background from distant galaxies and quasars indicate a contribution of ~10%. For the assumed case of emission by galactic halo neutrinos, an intensity upper limit of $\sim10^4$ photons $s^{-1}\ cm^{-2}\ sr^{-1}$ and a decay lifetime lower limit of 3×10^{24} s result. (44 refs.)

74184 The soft X-ray diffuse background. D.McCammon, D.N.Burrows, W.T.Sanders, W.L.Kraushaar (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Astrophys. J. (USA), vol.269, no.1, pt.1, p.107-35 (1 June 1983).
Maps of the diffuse X-ray background intensity covering essentially the entire sky with ~7° spatial resolution are presented for seven energy bands: 130-188 eV (B band), 160-284 eV (C band), 440-930 eV (M_1 band), 600-1100 eV (M_2 band), 770-1500 eV (I band), 1100-2200 eV (J band), and 1800-6300 eV (2-6 keV band). The data were obtained on a series of 10 sounding rocket flights conducted over a 7-year period. The authors attempt to make the absolute intensities in these maps quantitatively accessible while still giving a clear qualitative display of the spatial features. (84 refs.)

Decay of long-lived particles in the early Universe .... See Entry 73985
Radioastronomy antennas for 3K cosmic radiation measurements .... See Entry 73995
Analysis of complete quasar samples to obtain parameters of luminosity and evolution functions .... See Entry 74172
Optical and X-ray observations of faint quasars in an optically selected sample .... See Entry 74173
Spherical simulations of holes and honeycombs in Friedmann universes .... See Entry 74186

98.80 COSMOLOGY

(for observational cosmology, see 98.70V; for origin and evolution of galaxy, see 98.50)

74185 Numerical solutions of high-frequency perturbations in Bianchi type IX models. R.J.Slagter (Univ. of Amsterdam, Amsterdam, Netherlands).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.513-26 (15 May 1983).
The problem in perturbation theory in general relativity is finding a natural gauge which simplifies the equations considerably. The first and second order perturbation equations in the 'Lorentz gauge' are solved using the two-timing method. The equations were deduced from the equations of Einstein in the presence of a matter energy-momentum tensor of a perfect fluid with equation of state $p=(\gamma-1)\rho$. It is found that the 0-0 component of the first order equations together with the gauge conditions are consistent with the Bianchi type V model, without axial symmetry. It represents a 'ground state' situation of the Bianchi type IX model (Mixmaster model). The second order equations, describing the reaction back of the gravitational waves on the slowly varying background, give rise to rotation and will disturb the isotropization mechanism. The numerical solutions show all the features which are expected to appear. Moreover, it is found that the frequency of the perturbations increases with γ. (20 refs.)

74186 Spherical simulations of holes and honeycombs in Friedmann universes. G.L.Hoffman, E.E.Salpeter, I.Wasserman (Center for Radiophys. & Space Res., Cornell Univ., Ithaca, NY, USA).
Astrophys. J. (USA), vol.268, no.2, pt.1, p.527-39 (15 May 1983).
Presents extensive parameter studies of spherically symmetric models (without dissipation) of the formation of voids in the galaxy distribution, for cosmological density parameter $\Omega\leq1$ in a standard cosmology. Deep holes can form only if Ω is near unity, and an isolated deep hole is always accompanied by a dense, thin surrounding spherical 'ridge.' If one starts with underdensities at the cell centers of a regular lattice array, similarly deep holes and similar surrounding dense ridges (mimicking a honeycomb structure) form even in the absence of dissipation. The converse does not occur, i.e. a lattice array with overdensities at the cell centers forms dense clusters but no deep holes between the cells. The density contrasts at recombination required to form the observed holes and rich clusters are quite large, and smearing by radiative diffusion does not reduce the associated cosmic microwave background temperature fluctuations to the level required by the present observed upper limits to the small-scale anisotropy. The predicted anisotropy is non-Gaussian, giving the appearance of discrete sources of size ~10′. This discrepancy is particularly severe if Ω is small. Models with massive neutrinos and $\Omega\approx1$ are discussed, as are other possible resolutions to the dilemma. (53 refs.)

74187 Viscous cosmological models with matter and radiation. M.Szydlowski (Dept. of Philosophy, Pontifical Acad. of Cracow, Cracow, Poland), M.Heller.

Acta Phys. Pol. B (Poland), vol.B14, no.4, p.303-6 (April 1983).

Robertson-Walker world models filled with interacting matter and radiation, including the bulk viscosity dissipation, are constructed. It is shown that there exist stationary solutions in which the bulk viscosity term can be interpreted as phenomenologically describing a creation of matter and radiation. (12 refs.)

74188 The influences of massive neutrinos on clustering in the early Universe. Fang Li-zhi (Univ. of Sci. and Technol. of China, China), Liu Yong-zhen.

Commun. Theor. Phys. (China), vol.1, no.1, p.77-85 (1982).

The influence of massive neutrinos upon the clustering processes of cosmological matter in the early Jeans instability stage has been studied in the standard big bang theory. (7 refs.)

74189 Some inhomogeneous viscous fluid cosmological models of plane symmetry. S.R.Roy, O.P.Tiwari (Dept. of Math., Banaras Hindu Univ., Varanasi, India).

Indian J. Pure & Appl. Math., vol.14, no.2, p.233-43 (Feb. 1983).

Some plane symmetric solutions representing inhomogeneous cosmological models with viscous fluid distributions have been obtained. Special cases of perfect fluid distributions have been considered. (7 refs.)

74190 The renormalized coupling constant in an open static Einstein universe. Jia-Zhu Wang (Internat. School for Advanced Studies, Trieste, Italy).

Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.18, p.614-18 (30 April 1983).

The quartic self-coupling constant in an open static Einstein universe is investigated. The temperature and curvature effects to the coupling constant are discussed through the one-loop renormalized effective potential. (4 refs.)

74191 A scalar field with self-interaction leads to the absence of a singularity in cosmology. V.N.Melnikov, S.V.Orlov (State Committee for Stand., Moscow, USSR).

Phys. Lett. A (Netherlands), vol.95A, no.5, p.226-9 (2 May 1983).

A self-consistent treatment of the Higgs conformal field with spontaneously broken symmetry and gravitational field in the semiclassical approximation is shown (by computer calculation) to lead to the absence of a singularity in the anisotropic model if the domain structure is taken into account. (14 refs.)

74192 Time limit for hadronic phase transition in the big bang. J.Lodenquai, V.Dixit (Dept. of Phys., Univ. of the West Indies, Kingston, Jamaica).

Phys. Lett. B (Netherlands), vol.124B, no.5, p.317-20 (5 May 1983).

The evolution of the Robertson-Walker scale factor $R(t)$ during a first order phase transition from a quark-gluon plasma phase to a hadronic phase is investigated. In the $k=0$ case $R(t)$ is found to be oscillatory, a behaviour which sets an upper limit Δt_m to the time allowed for estimates of the actual transition time. Furthermore, Δt_m and the transition time are found to be fairly insensitive to the quark-gluon equation of state at a given transition temperature. (7 refs.)

74193 Could the metastable vacuum burn. V.A.Berezin, V.A.Kuzmin, I.I.Tkachev (Inst. for Nuclear Res. of the Acad. of Sci., Moscow, USSR).

Phys. Lett. B (Netherlands), vol.124B, no.6, p.479-83 (12 May 1983).

The equations of motion of an interface between two phases with an arbitrary equation of state are obtained. It is found that the process of vacuum burning can take place. It is shown that under certain conditions the process of the expansion of new phase bubbles is described by the equations of detonation waves. Possible cosmological consequences of the metastable phase burning effect are briefly discussed. (18 refs.)

74194 Formation of structure in an axion-dominated Universe. M.S.Turner (Astron. & Astrophys. Center, Univ. of Chicago, Chicago, IL, USA), F.Wilczek, A.Zee.

Phys. Lett. B (Netherlands), vol.125B, no.1, p.35-40 (19 May 1983).

The authors consider the formation of structure in a Universe dominated by axions of mass $\approx 10^{-5}$ eV ($f_{\mathrm{a}} \approx 10^{12}$ GeV). Because of their high phase space density and very low temperature, it is not difficult for axions to find their way into galactic haloes. With a suitable initial spectrum of density fluctuations, the present observed structure of the Universe could have evolved. However, the Zel'dovich spectrum, which is predicted by some inflationary Universe scenarios, is difficult to accommodate. (24 refs.)

74195 Inflationary universe with gravity. E.Mottola (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), A.Lapedes.

Phys. Rev. D (USA), vol.27, no.10, p.2285-93 (15 May 1983).

The original idea of the inflationary universe is shown to be consistent with observation, if the effects of spacetime curvature are considered. Specifically, a combined grand-unified-gravitational tunneling solution exists, which is homogeneous over the entire spatial section and has lower action than the flat-space, inhomogeneous bubble. Thus, the exit from the metastable de Sitter phase can occur gracefully, without generating large spatial inhomogeneities or magnetic monopoles. The large expansion factor is generated naturally by the tunneling amplitude and does not require fine tuning the initial conditions of the post-tunneling evolution. Fluctuations in this model may differ substantially from the roll-over picture. (24 refs.)

74196 Fluctuations in the homogeneous inflationary Universe. E.Mottola (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).

Phys. Rev. D (USA), vol.27, no.10, p.2294-8 (15 May 1983).

Quantum fluctuations in the homogeneous inflationary Universe are shown to give rise to inhomogeneities of the right spectrum and magnitude needed to form galaxies. (15 refs.)

74197 Vacuum energy and large-scale structure of the Universe. V.F.Mukhanov, G.V.Chibisov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).

Sov. Phys.-JETP (USA), vol.56, no.2, p.258-65 (Aug. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.2, p.475-87 (Aug. 1982). [received: May 1983]

Small longitudinal quantum fluctuations of the metric in cosmological models with metastable vacuum are considered. A Hamiltonian formalism is constructed and the system of small perturbations quantized. The single-loop corrections are taken into account in the Einstein equations. The stability of the models with respect to perturbations of the metric is investigated. The spectrum of fluctuations of the metric is calculated. Under certain conditions, the amplitude of the spectrum is sufficient for the formation of galaxies during the hydrodynamic stage after the decay of the polarized vacuum. (19 refs.)

Evolution of the Universe .... See Entry 69809

Bianchi type-I models with conformally invariant scalar field .. See Entry 69945

Supergravity generates hierarchies .... See Entry 69961

Cosmological character of the Higgs field .... See Entry 70268

Constraint on the photino mass from cosmology .... See Entry 70275

Gauge hierarchy generation and cosmology in locally supersymmetry GUTS .... See Entry 70278

Cosmological-type constant derived in a unified field theory .... See Entry 70290

Supersymmetric grand unified theories and cosmology .... See Entry 70291

Thermodynamics of extended hadrons with baryon number ..... See Entry 70342

Non-LTE astrophysics and the origin of high energy cosmic rays .... See Entry 73961

Decay of long-lived particles in the early Universe .... See Entry 73985

The minimum period and the gap in periods of cataclysmic binaries .... See Entry 74073

Analysis of complete quasar samples to obtain parameters of luminosity and evolution functions .... See Entry 74172

A new test of the cosmological interpretation of QSO redshifts .... See Entry 74177

Author index

a la Guillaume, C.Benoit ..see Benoit a la Guillaume, C.
+Aalto, P.K. 73665
Abaev, V.V.+ 70542
Abakumov, G.A.+ 71186
+Abalakin, V.K. 74004
Abart, J.+ 72691
+Abbakumov, V.G. 73045
+Abbasova, R.U. 72512
Abbate, M.+ 73832
Abboud Ja'Afar Hadi ......see Ja'Afar Hadi Abboud
+Abd El-Salam, F. 72534
+Abdeen, A.M. 72525
Abdel-Kader, M.M. 71038
Abdel-Kader, M.M. 72576
+Abdel-Kader, M.M. 72585
Abdel-Malik, T.G.+ 72525
Abdelsalam, A.+ 70588
+Abe, F. 71216
Abe, R.+ 70016
+Abe, Y. 70444
+Abe, Y. 70574
+Abeles, B. 72437
Abeles, M. 73696
+Abelson, J.R. 71824
Abesadze, T.Sh.+ 72723
Abraham, F.F. 71862
Abram, I.+ 72320
+Abrams, G.S. 70399
Abramski, K.M. 71106
Abramski, K.M.+ 71166
+Abshire, G. 70419
Aburdzhaniya, G.D.+ 71750
Accioly, A.J.+ 69945
Acevedo, R.+ 70842
Achache, J.+ 73774
Achiba, Y.+ 70950
+Ackerman, C. 73455
+Ackermann, U. 71773
+Ackerson, B.J. 71864
Actor, A. 70226
+Adachi, G.-y. 72392
Adachi, H.+ 72770
Adachi, S. 70526
+Adam, J. 72761
Adam, J., Jr.+ 70458
Adamchuk, V.K.+ 72495
Adamchuk, V.K.+ 72939
Adamiak, K. 71049
Adams, D.M.+ 72785
Adams, M.R.+ 70419
+Adamyan, S.Ya. 73550
Adcock, J.C., Jr.+ 71705
Addeo, A.+ 73438
+Adiga, B.B. 73854
Adler, C.G.+ 69815
Adler, J.G.+ 72549
+Adler, L. 70618
Adler, S.L. 70328
+Adloff, J.C. 70575
+Adolph, H.G. 73339
Adomian, G.+ 69858
+Adrianovskii, B.P. 72639
Adshead, J.D. 73782
Adshead, J.D. 73843
Adshead, J.D. 73844
+Adzhemyan, L.Ts. 72757
Adzhemyan, L.V.+ 72757
Aeberli, K.E.+ 73234
+Aeppli, G. 72623
Aeppli, J. 70655
+Afanas'ev, A.M. 73520
+Afanas'eva, N.I. 71876
+Affolter, H. 73695
+Afinogenova, N.S. 73045
+Africano, J.L. 74106
Agakishiev, G. 70583
+Agapov, L.I. 71768
Agarwal, B.K.+ 72367
Agarwal, G.S.+ 71190
Agarwal, S.K.+ 73449
+Agarwal, Y.K. 70641
Ageev, A.I.+ 71633
Ageev, V.P.+ 71758
+Aggarwal, M.M. 70590
Aggarwal, S.K.+ 73854
+Agitanand, N. 70595
Agmon, N. 70798
Agostinelli, E.+ 72695
Agrawal, G.P. 71203
+Agren, H. 70951
Agrenich, E.A.+ 73898
Aguado, M.+ 70966
+Aharoni, S.M. 71867
+Aharonov, Y. 69927
+Aharony, A. 70007
+A'Hearn, M. 74047
+A'Hearn, M.F. 74050
Ahlers, G.+ 71573
+Ahlers, G. 71572
+Ahmed, F. 70643
Ahn Sung Tae .see Sung Tae Ahn
+Ai Ke-cong 71064
+Aiba, H. 71503
+Aikyo, K. 73960
+Airaksinen, V.-M. 72014
Aird, G.R.+ 73060
Aivazova, L.S.+ 72417
Aiyer, R.N. 71178
+Ajithkumar, C.M. 70235
+Akashi, T. 73124
+Akbarzadeh, A. 73476
+Akbd El-Halim, S. 70554
Akhmadiev, F.G.+ 71635
Akhmanov, S.A.+ 71174
Akhmediev, N.N. 71176
Akhmedov, T.M.+ 69897
Aki, K. 73727
Aki, K. 73735
Akimov, A.G.+ 73255
Akimov, L.A.+ 74002
Akimov, V.N.+ 70899
Akselrod, Z.Z.+ 72718
Aksenov, E.P.+ 74094
+Aksenov, M.S. 72969
Aksenov, V.K.+ 71967
Aksenov, V.L.+ 72595
Aksentyan, O.K.+ 71360
Akulenko, L.D.+ 69872
Al Awar, A.+ 70864
Al-Douri, A.A.J.+ 72879
+Al-Shamma, S.H. 70951
Alard, J.P.+ 70753
+Alario Franco, M.A. 73388
+Alario-Franco, M.A. 72254
Alastuey, A.+ 72432
+Alavi, K. 71118
Albada, G.D.van ....see van Albada, G.D.
+Albajar, C. 70307
+Albaugh, D.S. 73768
+Albergamo, V. 73463
Albers, W. 71955
Albert, J.L.+ 70884
Alberti, P.M.+ 69919
Alberty, J.M.+ 70249
Albon, N. 73521
+Albrecht, A.C. 70960
Albrecht, G.F.+ 71144
+Aldana, R. 72176
Aldazabal, G.A.+ 70363
+Aldred, A.T. 72636
+Aleev, A.N. 70413
+Aleinikov, S.M. 71570
+Aleklett, K. 70624
Aleksandrov, E.B.+ 72713
Aleksandrova, I.P.+ 72740
+Aleksandrovskii, A.A. 71635
Alekseev, S.A.+ 70105
Alekseyev, S.I.+ 73632
Alexander, C.+ 74063
+Alexander, G. 73451
+Alexander, J. 70595
+Alexander, J.M. 70578
Alexandre, D.+ 70677
Ali, A.+ 70302
Alicki, R.+ 70241
Aliev, F.G.+ 72403
Alikaev, V.V.+ 71768
Alkhazov, G.D.+ 70507
Allasia, D.+ 70368
+Allegre, C.J. 73764
Allen, B.+ 69965
Allen, C.R. 73736
Allen, D.C.+ 70994
Allen, P.B.+ 72302
Allen, R. 73929
Aller, L.H.+ 74136
Allison, I. *(ed.)* 69794
+Allison, W. 72199
+Alnot, M. 72241
+Aloi, A.S. 70671
+Alonso, J.A. 70767
+Alonso, J.A. 72123
+Alperin, B.J. 73174
+Alquie, G. 72658
+Alsmiller, R.G., Jr. 73396
Alti, G.de........see de Alti, G.
Al'tshuler, S.A.+ 72817
+Alvarado, S.F. 72584
Alvarino, J.M.+ 73315
+Aly, A.A. 72525
+Amano, T. 71039
Ambach, W.+ 73668
Ambartsumyan, T.G.+ 73550
Ambjorn, J.+ 70298
+Ameerjan, S. 70067
+Amidei, D. 70399
+Amikura, I. 73948
+Amoureux, J.P. 71882
+Amoureux, J.P. 72694
Amuasi, J.H.+ 73660
Amusa, A.+ 70440
+An-Ban Chen 72305
Anand, K.+ 73225
Anan'in, O.B.+ 71760
Ananthakrishna, G.+ 71404
+Ananthakrishna, G. 69986
+Anderson, A. 72795
+Anderson, B.D. 70600
+Anderson, B.D. 70601
+Anderson, C.M. 73691
Anderson, D. 71755
Anderson, D.L. 73766
+Anderson, J. 72951
+Anderson, J.L. 72172
Anderson, L.M. 73450
Anderson, O.L. 73767
Anderson, P.W. 72340
+Anderson, P.W. 71922
+Anderson, R.B. 71048
Ando, E.+ 73470
+Ando, K. 72870
+Ando, K. 72157
Andrade e Silva, J.+ 69917
Andreae, M.O. 73877
+Andreae, M.O. 73869
Andreev, A.A. 71738
Andreev, N.E.+ 71740
Andreeva, T.L. 73350
Andreeva, T.L.+ 73330
Andreeva, T.L.+ 73348
Andreeva, T.L.+ 73351
Andreeva, T.L.+ 71029
Andreeva, T.L.+ 73349
Andreone, D.+ 70079
+Andreoni, A. 70118
+Andrews, B. 72795
Andrews, E.H.+ 73271
+Andrews, H.R. 70431
Andrews, L.+ 70945
Andric, L.+ 71024
+Andriesse, C.D. 70676
+Andrieu, C.G. 72765
Andrievskii, R.A.+ 73208
Andronenko, L.N.+ 70633
Andronov, A.N.+ 72935
Angadi, M.A.+ 72517
Angelelli, J.M.+ 70783
Angelescu, N.+ 71044
+Angelini, C. 70368
+Angell, C.A. 72082
+Angell, C.A. 71898
Angell, J.B.+ 70051
Angelopoulos, E. 69856
Angelsen, B.A.J.+ 73647
+Angers, L.M. 71962
Anglada, J.+ 70784
+Anglada, J. 70785
Aniansson, G.+ 73600
Aniansson, G.+ 73599
Anikeev, D.I.+ 72051
Anisimov, S.I.+ 71735
+Anisimov, V.I. 72603
Anjos, J.C.+ 70415
Ann Jae-Bong ....see Jae-Bong Ann
+Anna, L.O. 73777
+Annis, C.G., Jr. 73170
+Ansell, M.P. 73141
+Ansorge, R.E. 70405
+Antalik, R. 70482
+Antanasijevic, R. 70630
+Anthonio, F.E. 72710
Antipin, M.Yu.+ 71035
Antoncik, E.+ 72722
Antonenko, V.M.+ 72045
Antoniadis, I.+ 70337
Antoniou, N.G.+ 70340
+Antonov, A.A. 73131
Antonov, A.N.+ 70557
Antonova, L.I. 72941
Antonucci, R.R.J. 74158
+Antsiferov, P.S. 71208
Anufriev, E.V.+ 72510
+Aoki, K. 73381
Aoki, S.+ 73978
Aoki, T. 70719
+Aoki, Y. 72005
+Aono, M. 72955
+Aono, S. 70782
+Aoyagi, Y. 72329
Aoyama, S.+ 70280
+Apelblat, A. 72122
Apeldoorn, G.W.van ..see van Apeldoorn, G.W.
Aponin, G.I.+ 71795
Apostolov, A.+ 72586
+Appenzeller, I. 74087
+Appert, K. 71728
+Apple, W. 73606
+Applebury, M.L. 73531
Aquilanti, V.+ 73316
Arai, K.+ 71323
+Arai, M. 72582
Arai, M.R. 72457
+Arai, T. 72840
Araki, H.+ 72937
Araki, S. 73986
+Araki, S. 71323
Aratyn, H.+ 70279
Araujo, R.J. 72121
Arbique, G.M.+ 70713
Ardashev, V.I.+ 70064
Arditi, A.+ 73580
+Arditty, H.J. 71246
Are, A.L.+ 73850
Aref'eva, I.Ya. 70203
+Arefiev, V.A. 70413
Arens, R. 70184
Aresti, A.+ 69841
Argent, B.B.+ 72118
+Arghode, R. 73284
+Arias, M. 72467
Arieli, A.+ 73168
+Ariga, K. 73500
+Arimento, C.A. 72411
+Arishima, K. 70083
+Arjavalingam, G. 71153
Arkhipov, V.A.+ 71614
+Armand, G. 72466
+Armand, G. 72927
Armandillo, E.+ 71108
+Armas, B. 72997
Armour, R.S., Jr.+ 69813
Armstrong, B.H. 71687
+Arnaud, J. 71238
+Arnaudov, M. 71886
Arndt, E.+ 70809
+Arndt, R. 73007
Arndt, R.A.+ 69816
+Arndt, R.A. 73446
Arnesen, A.+ 70823
Arnold, J.M.+ 73807
+Arnold, T.H. 72812
Arnold, W.+ 72546
Arnott, H.J. 73525
+Arnott, H.J. 73524
Arnott, R.J. 73794
+Arora, A.K. 72819
Arora, S.K.+ 72978
+Arp, H. 74154
+Arp, H. 74166
+Arqueros, F. 71020
+Arri, E. 70079
Arrowsmith, D.J.+ 73012
+Arsen'ev, Yu.I. 71768
Art, R.L.Van ....see Van Art, R.L.
Artamonov, O.M.+ 72902
+Artemenko, O.G. 71335
Artemenkov, L.I.+ 71769
Artem'yev, M.Ye.+ 73758
Artyshev, S.G.+ 71599
Arushanov, G.G.+ 70406
+Arushanov, V.G. 70406
Aryaeinejad, R.+ 70442
Arzhannikov, A.V.+ 71753
Asakawa, S.+ 73368
Asano, S. 71067
Ashmontas, S.P.+ 72500
Ashok, S.+ 72471
Ashton, G. 70130
Ashwell, G.J.+ 72394
Aslanides, E.+ 70584
Asorey, M.+ 69912
Aspnes, D.E. 72755
+Aspnes, D.E. 72831
+Asthana, B.P. 70886
Astley, R.J.+ 71277
+Ata, M. 70846
Atanov, Yu.A.+ 71590
Atarashi, M. 70407
+Atia, M.T. 71072
+Atkins, E.D.T. 71868
Atkinson, C.M.L.+ 70033
+Ato, Y. 71991
+Atoda, T. 72980
Attal, J. 71324
+Attwood, D.T. 70159
+Atwood, W.B. 70394
+Au, B.C. 71261
+Au, C. 69898
Au, C.K.+ 69927
Au, W.W.L.+ 73593
Au-Yeung, S.C.F.+ 70904
Au-Yeung, S.C.F.+ 70905
+Aubard, J. 70884
+Auble, R.L. 70597
+Auble, R.L. 70608
+Auble, R.L. 70617
Aubry, S. 70013
+Aude, G. 70660
+Audi, G. 71030
+Auerbach, D.J. 72908
+Augerat, J. 70753
+Aulombard, R.L. 72348
Aurich, D.+ 70696
+Aussenegg, F.R. 71100
+Aust, H. 72726
Auston, D.H. 72442
Avaliani, I.S.+ 70323
+Avalos, D. 71327
Avchukhov, V.D.+ 70483
Avduyevsky, V.S.+ 73075
Avenel, O.+ 72178
Avignone, F.T., III+ 70497
+Avni, Y. 74172
Avramides, E.+ 70840
Avtonomova, I.V. 70070
+Awadallah, R.M. 71950
Awar, A.Al..see Al Awar, A.
+Awe, B. 71014
+Awes, T.C. 70561
Awwad, A.M.+ 72024
+Axen, D.A. 70539
Ayukhanov, R.A.+ 72767
Azarenkov, N.A.+ 71737
+Azarov, V.V. 72007
Azcoiti, V.+ 70229
Azizov, U.V.+ 72220
Azizov, U.V.+ 72219
Azizova, D.Kh.+ 72474

+Baba, H. 70935
+Baba, H. 73925
Babaliev, A.M.+ 73891

Babanova, E.N.+ 71932
Babelon, O.+ 72572
Babelot, J.-F.+ 72137
+Baberschke, K. 72671
Babic, E.+ 72637
Babich, S.Iu.+ 69878
+Babij, T.M. 70041
+Babinet, R. 70753
+Babkin, V.I. 73330
Babu, P.Ram *see* Ram Babu, P.
+Babu Joseph, K. 70236
Babunashvili, I.N.+ 73533
Baby, B.V.+ 70236
Bach, H.G.+ 71225
Bache, T.C. 73731
Bachin, I.V.+ 71716
+Backus, P.R. 74095
Bacri, J.+ 71828
Bacri, J.+ 71829
Badaev, A.N.+ 73305
+Badan, B. 73117
Badawy, O.E.+ 70560
+Badawy, O.E. 70554
Badier, J.+ 70418
Badot, J.C. 70063
Badrakhan, F. 69867
+Badurek, G. 70738
Badzhinyan, S.A+ 73534
Baer, T.+ 71311
Baeva, E.D.+ 70161
Bagaasen, L.M.+ 73058
Bagai, R.K.+ 72982
+Bagchi, B. 70267
+Bagchi, B. 74102
+Baggeroer, A.B. 73786
Bagirov, A.G.+ 72872
+Bagirov, S.Yu. 72872
Baglin, F.G.+ 70881
Bagraev, N.T. 72699
Bagraev, N.T.+ 72701
Bagraev, N.T.+ 72700
Bagraev, N.T.+ 72703
Bagriantsev, N.V.+ 73806
Bai-lin Hao *see* Hao Bai-lin
Bai-ling Yan *see* Yan Bai-ling
+Bailey, A.G. 73378
+Bailey, J.E. 72140
+Bailey, J.E. 72141
Bailey, R.T.+ 72793
Bailin, D.+ 72538
+Bairamashvili, I.A. 73208
+Baird, I.L. 73603
+Bajaj, K.K. 71983
Baker, A.J.+ 71524
Baker, D.A.+ 71787
Baker, H.C. 70834
+Baker, M. 70313
Baker, W.F.+ 70409
+Baklanova, S.M. 73549
+Bakun, O.V. 73220
Bala, S.Lakshmi *see* Lakshmi Bala, S.
Balachandran, A.P.+ 70277
+Balachandran, A.P. 69932
+Balakirev, V.F. 71946
Balakrishan, K.+ 73284
+Balandin, B.P. 70413
+Balant, A.C. 72929
Balanzat, E.+ 71931
Balashova, L.L.+ 72907
Balbas, L.C.+ 70767
Baldacchini, G.+ 72839
+Baldereschi, A. 72307
Baldo, M.+ 72294
+Baldwin, A.R. 70601
+Baliga, B.J. 72471
Balitsky, I.I. 70301
+Balkanski, M. 72804
Balkova, A. 70787
+Ball, J.B. 70597
+Ball, J.B. 70608
+Ball, R. 73860
Ball, T. 73907
+Ballantyne, J.M. 71223
+Ballman, A.A. 72163
Balmino, G.+ 74010
Balodis, Ya.K.+ 72433
Baltz, A.J.+ 70573
+Balukova, V.D. 70657
Balzano, V.A. 74141
+Balzarotti, A. 72887
Bando, H.+ 70474
+Bandura, V.M. 72868
Banerdt, W.B.+ 74006
+Banerjee, A. 72293
Banerjee, B.+ 72642
+Banerjee, P.K. 72838
+Banerjee, P.K. 72261
+Banerjee, S. 70714
+Banerjee, T. 73457
Bangash, Y. 70717
Bange, K.+ 72242
+Banifatemi, A. 73389
+Banks, M.S. 73572
Bansal, N.P.+ 71889
Bao Zongyu+ 70629
+Baraban, A.P. 72526
+Barak, J. 72686
Baran, E.J.+ 72808
Baranchuk, S.I.+ 72942
+Baranik, A.T. 70554
+Baranov, L.A. 70031
Baranov, P.G. 72714
Baranova, N.B.+ 71071
Baranovskii, S.D.+ 72135
Baranskii, P.I.+ 72396
Baranskii, P.I.+ 72429
Barash, Y.B.+ 72686
Barashkov, M.S.+ 71204
Baratka, S. 73435
+Barbara, P.F. 70940
+Barbara, P.F. 70939
+Barber, J.R. 71399
Barbier, M. 70919
Barbieri, C.+ 74001
+Barbosa, G.A. 72816
Barbour, J.B. 69853
Barchuk, V.I. 70090
Barcik, J. 73088
+Barcza, G. 72278
Bareika, B.F.+ 70958
Barenblatt, G.I. 72040
Barenblatt, G.I. 72042
Barfield, A.F.+ 70492
Barhen, J.+ 73396
+Barie, P.S. 73678
Barker, J.A.+ 72908
+Barker, R. 71855
Barkhatov, V.P.+ 71946
+Barlag, S. 70368
+Barna, A. 72282
Barna, P.B.+ 72761
Barna, P.B.+ 72278
Barnard, T.E. 71274
Barnard, W.R.+ 73869
+Barnett, E.H. 73629
+Barnett, P.D. 71333
+Barnett, S.A. 72752
+Barnett, T.G. 73693
Barnett, T.P. 73805
+Barnham, K.W.J. 70307
+Barnwell, J.M. 70563
+Baro, M.D. 71887
+Baron, J.C. 73697
Baron, R.L.+ 74036
+Barr, P. 74072
Barranco, M.+ 70477
+Barrere, M. 73670
Barret, C.+ 72493
+Barrett, B.R. 70492
Barron, L.D.+ 72797
Barry, J.C.+ 72019
Bars, R.Le *see* Le Bars, R.
Barshay, S. 70373
+Barsova, L.I. 70698
+Bartanyan, A.G. 73548
Barteau, M.A.+ 72222
Bartell, U.+ 72057
+Bartelt, N.C. 72903
+Bartetzko, R. 70946
+Barth, P.W. 70051
+Barthes-Labrousse, M.G. 72958
Bartke, J. 70536
+Bartmess, J.E. 73321
+Bartolome, J. 72133
Barton, G. 69817
+Barton, J.W. 70846
Barut, A.O.+ 70195
+Barut, A.O. 70385
Barve, V.D.+ 71394
Basak, S. 72374
+Basha, M.J. 72390
+Bashta, V.V. 73308
+Basile, G. 72190
+Basinska, E.M. 74109
Baskakov, O.I.+ 70855
Baskakov, V.N.+ 71451
Basko, M.M. *(tr.)* 69809
+Baskova, K.A. 70483
Basmat, O.S. 71630
+Basri, G.S. 74107
Bass, V.P.+ 71605
+Bastin, G. 73111
Bastun, V.N. 73159
+Basturk, N. 71872
+Basu, B.K. 70069
Basu, P.+ 73457
Batalin, G.I.+ 72257
+Batchelder, D.N. 71247
Bates, D.R. 70988
Bates, F.S.+ 71909
Bateson, F.M. 74084
+Batifol, E. 72320
Batra, A.K.+ 72742
+Bats, J.E. 71935
+Batteh, J.H. 71804
Battistoni, C.+ 72956
Battocletti, J.H.+ 73650
Batyreva, O.V.+ 73897
+Baud, G. 72808
Baudin, C.+ 72113
+Baudoing, R. 72476
+Baudoing, R. 71841
Bauer, E.+ 72249
Bauer, H.F. 71557
+Bauer, J.W. 71303
+Baulieu, L. 70337
Baum, H.R.+ 71333
+Baumann, H. 70846
+Baumhertel, K. 71740
+Bauminger, E.R. 73507
+Baumshtein, M.V. 73305
+Baur, W.H. 71941
Bauschlicher, C.W.+ 70763
+Bava, E. 70035
+Bazant, Z.P. 71439
Bazhenov, N.L.+ 72420
+Bazilevskii, A.T. 74008
Bazylev, V.A.+ 72022
+Beach, J.L. 73644
Beach, R.+ 71206
+Beattie, W.H. 70872
+Beattie, W.H. 70894
+Beauchamp, A.L. 70859
+Beavers, W.I. 74108
Beavis, D.+ 70585
Becher, P. 70166
+Bechstedt, U. 70562
+Beck, F. 70572
+Beck, H. 71984
+Becker, G.E. 72913
Becker, W.+ 71032
+Bedford, J.S. 73640
Bednar, J. 73635
Beeck, J.op de *see* op de Beeck, J.
Beg, M.A.B. 70285
+Behm, R.J. 72237
+Behn, R. 71790
+Behringer, K. 71749
+Behroozi, F. 72556
Beiser, L. 71086
Bekenstein, J.D. 69950
+Beker, H. 70195
+Bekrenev, V.S. 70542
Belanger, P.A.+ 71193
Belanger, P.-A.+ 71207
Belcastro, V.+ 73957
+Bel'chenko, G.V. 72717
Belenov, E.M.+ 72869
Beletskii, N.N.+ 72338
Belevskii, V.P.+ 72999
+Belfanz, E. 73493
Beliaev, A.Iu. 71424
Belinicher, V.I.+ 72451
Belitz, D.+ 72286
Bel'kov, S.A.+ 71714
Bell, J.S.+ 73779
Bell, J.S.+ 70005
Bellagamba, V.+ 70781
Bellazzini, R.+ 70752
Belleney, J.+ 70918
Bellessa, G. 72056
Bellotti, E.+ 70383
Bellotti, E.+ 70499
+Belobrovaya, O.Ya. 72750
+Beloglazov, Yu.A. 70542
Belokon, A.V. 71420
Belostotsky, S.L.+ 70552
Belotserkovskii, O.M.+ 71548
Belouet, C. 73016
+Belousov, A.S. 70413
Belousova, I.M.+ 71167
Belov, S.P.+ 70854
+Belozerskii, G.N. 72717
Belyak, V.I.+ 70540
Belyakov, V.A.+ 72758
Belyantsev, A.M.+ 72408
Belykh, S.F.+ 72873
+Belytschko, T. 71370
+Ben-Avraham, D. 70001
+Ben-Dor, L. 71943
Ben-yu Guo *see* Guo Ben-yu
+Benchimol, J.L. 72521
Bendall, M.R.+ 70926
Bender, C.M.+ 70017
Bendow, B.+ 72838
Bendt, P. 73479
+Bendura, R.J. 73494
+Benech, B. 73855
Benedek, G. 72209
Benedictis, S.De *see* De Benedictis, S.
Benet, S.+ 72997
+Benford, G. 71748
Benhar, O. 70479
Benjwal, M.P.+ 70238
Benn, I.M.+ 70259
Benndorf, C.+ 72959
+Bennemann, K.H. 73334
+Bennemann, K.H. 73522
Bennett, A.+ 73288
+Bennion, D.N. 73342
Benoit a la Guillaume, C. 72318
Benson, R.C.+ 71172
+Benson, S.M. 73846
+Bensoussan, M. 72894
+Bentley, G.E. 73664
+Bentley, J. 72018
+Bentley, J.R. 70072
+Bentolila, F. 72188
+Benvenuti, P. 74047
+Beorchia, A. 71842
Berberian, M 73753
+Berdenikov, A.I. 71590
Berdichevskii, V.L. 71423
Berecz, I.+ 70144
Berecz, I.+ 70143
+Berecz, I. 70071
+Berens, A.P. 73171
Berezin, A.A. 72407
Berezin, A.A. 72858
Berezin, V.A.+ 74193
Berezina, A.L.+ 73085
Berezine, I.V.+ 70135
+Berg, G.P.A. 72917
+Bergamasco, L. 73831
Bergaya, F.+ 72851
+Berge, R. 72997
+Bergeal, J.-M. 73742
+Bergman, A. 70866
Bergman, D.J.+ 72368
Bergmann, G. 72377
Bergonzoni, C.+ 72620
Bergshoeff, E.+ 69963
+Bergstrom, B. 70659
+Berjoan, R. 73467
+Berkowitz, G.M. 70639
+Berkowitz, J. 70949
+Berlin, Yu.A. 72366
+Berliozov, A.B. 71768
Berman, G.P.+ 69921
Berman, S.M. 69979
+Bernabei, S. 71729
+Bernard, A. 70672
Bernard, C. 72994
Bernard, J.J.+ 71235
Bernardi, F.+ 70985
+Bernas, A. 72303
Bernas, M.+ 70445
Bernasek, S.L. 73367
Bernath, P.F.+ 71039
+Bernatskii, D.P. 72901
Bernaud, C.+ 70707
+Berney, C.V. 71909
Bernheim, M.+ 72243
Bernholc, J.+ 70768
+Bernier, J.C. 72612
+Bernstein, E.R. 70893
+Bernstein, E.R. 70892
Bernstein, R.L. 73942
+Bernstein, R.L. 73814
+Bernthal, F.M. 70441
+Berreby, L. 70860
+Berret, J.F. 72062
+Berry, R.J. 70885
+Berry, R.S. 72078
Bers, W.A.M.van *see* van Bers, W.A.M.
+Bersuker, I.B. 72360
+Bertanza, L. 70368
+Bertault, D. 70602
Bertolotti, M. 69805
+Bertran, J. 73314
+Bertrand, F.E. 70597
+Bertrand, F.E. 70608
+Bertrand, F.E. 70617
Bertsch, G.F. 70437
Beryland, M.E.+ 73503
Berzin', Ya.Ya.+ 70487
+Bes, A. 73670
Besenyei, E.+ 72280
Besfamil'nyi, P.V.+ 71656
Beskos, D.E.+ 71353
Bespalov, V.I.+ 72759
Bespyatykh, Yu.I.+ 72647
+Besse, J. 73774
+Besse, J.-P. 72808
+Besshaposhnikov, A.A. 71795
Bessonov, Yu.L.+ 71137
+Best, W.J. 73730
+Betak, E. 70533
+Betskii, O.V. 73633
Beukel, A.van den *see* van den Beukel, A.
+Beuselinck, R. 70307
+Bezemer, J. 72998
+Bezmenova, T.E. 71035
+Bezrodnyi, V.I. 73333
Bezryadin, S.N.+ 72459
Bhadeshia, H.K.D.H. 73081
+Bhagiradha Rao, E.S. 73204
Bhagwan, J.+ 73937
Bhakuni, D.S.+ 70179
Bhakuni, D.S.+ 70240
Bhanja, R.+ 70589
Bhanot, G.+ 70219
Bharati, R.+ 72385
+Bhardwaj, A.P. 73331
Bhargava, A.K.+ 73471
Bhargov, P.K.R.+ 71347
Bhatla, S.C.+ 70862
+Bhatnagar, A.K. 72372
+Bhatnagar, A.K. 73190
Bhatt, B.S. 71636
+Bhatt, D.D. 73174
Bhattacharya, R.S.+ 71987
Bhattacharya, R.S.+ 72272
Bhattacharya, R.S.+ 71994
+Bhattacharya, R.S. 71992
Bhatti, S.S.+ 72047
Bhowmik, R.K.+ 70591
+Bhowmik, R.K. 70518
Biagini, S.+ 70914
+Biancaniello, F.S. 72090
+Bianchi, F. 70368
Biasi, R.S.De *see* De Biasi, R.S.
Biberman, L.M. 70095
+Bice, A.N. 70619
+Bichevin, V.V. 72972
Bickel, W.+ 70621
Bickerton, R.J. 70724
Bielli, P.+ 73995
Bieniasz, L.+ 70715
Bienstock, S.+ 71008
+Bigi, A. 70368
Bigun, G.I.+ 72218
Bijalwan, R.D.+ 72175
Bilenko, D.I.+ 72750
+Billmann, A. 72546
+Billon, A. 70677
+Bilpuch, E.G. 70528
+Bimbot, R. 70603
+Binder, K. 72624
Bindschadler, R.A.+ 73848
Binegar, B.+ 69960
+Bing-lin Gu 72722
+Bingemer, H. 73869
Binnig, G.+ 72197
Binns, C.+ 72958
+Birattari, C. 70548
Birch, J.A.+ 72604
Birck, H. 72985
Bird, I.G. 73950
Bird, R.E.+ 73422
+Birich, G.N. 73348
+Birkelund, J. 70609
+Birulev, V.K. 70413
+Biryukov, E.P. 73382
Bishop, T.A.+ 73199
+Bisi, V. 70368
Biskamp, D. 71711
Bisnovatyi-Kogan, G.S.+ 74100
+Bist, H.D. 72796
+Bist, H.D. 72779
Biswas, P. 71441
Biswas, S.+ 73221
Biswas, S.H.+ 70237
Biswas, S.N.+ 70356
Bityurin, N.M.+ 73344
+Bivas, A. 72805
+Bizau, J.M. 70829
Bizzeti Sona, A.M.+ 70490
+Bjerre, N. 72673
+Bjoraker, G.L. 74034
Bjork, L.+ 71253
+Bjorkman, M. 73600
Blacha, A.+ 72363
Black, G.R.E.+ 70252
Blais, J.A.R.+ 73705
+Blais, J.C. 72239
Blandford, R.D. 73988
Blandford, R.R. 73729
Blandin, J.+ 71697
+Blasi, P. 70490
+Blayer, A. 72726
Blazhnova, E.I.+ 72221
+Bleehen, N.M. 73552
Blinov, L.M.+ 70929
Bliokh, Yu.P.+ 70732
+Bliss, T.V.P. 73700
Bloch, D.+ 71201
+Block, J.H. 72238
+Block, M.M. 70414
+Blocker, C.A. 70399
Blokhintsev, L.D.+ 70508
Blomberg, M.+ 72014
+Blondel, A. 70399
+Blumenfeld, Y. 70598
+Blumlein, J. 71694
Bluyssen, H.J.A.+ 71126
+Blyakher, E.V. 70748
Blyholder, G.+ 70780
Blythe, A.R. 70087
+Blythe, P.A. 71587
+Bo, H. 71830
Bobbink, G.J.+ 70414
+Bobisut, F. 70368
Bobkov, N.N. 71639
+Bobkov, V.V. 73382
+Bobrova, E.A. 72512
+Bobrova, N.P. 70751
+Bocharov, L.D. 73045
Bochkarev, V.V.+ 71359
+Bock, R. 70576
Bock, R. *(ed.)* 69804
Bocker, D.+ 73394
Bodek, A.+ 70394
+Bodo, Z. 72761
Bodvarsson, G.S.+ 73846
Boehm, F. 70245
+Boehme, R.F. 72885
Boekema, C.+ 72724
Boer, F.W.N.de *see* de Boer, F.W.N.
+Boerma, D.O. 72720

+Boerma, D.O. 72721
+Boero, G.C. 72190
+Boesch, W.J. 73079
Boettinger, W.J. 72088
+Bogatov, A.P. 71137
+Bogdanoff, L. 71471
+Boggess, T.F. 71189
+Bogoboyashchii, V.V. 72454
Bogolyubov, N.N., Jr.+ 71099
Bogomolov, G.I. 71332
Bogushevich, A.Ya.+ 73952
Bohatka, S.+ 70071
+Bohatka, S. 70143
+Bohatka, S. 70144
+Bohlen, H.G. 70596
Bohme, G.+ 71651
Bohn, C.L. 74119
+Bohnert, K. 72325
Bohrer, M.P. 73365
+Boiko, N.B. 71418
Boiko, V.I.+ 72431
+Boizau, C. 72202
Boiziau, C. 72930
+Boiziau, C. 72835
+Bokovaia, E.K. 71599
+Bokovoi, V.A. 71599
Bolbach, G.+ 72239
+Boldyshev, V.F. 70739
Bolkhovityanov, Yu.B. 72271
+Bolognese, T. 70368
+Bolognese, T. 70307
Bol'shov, L.A. 71957
Bolt, B.A.+ 73749
Bomben, K.D.+ 70948
+Bombot, R. 70592
+Bonacic-Koutecky, V. 71045
+Bonadies, V. 73438
Bonardi, M.+ 70548
Bonch-Bruevich, A.M.+ 72010
Bonch-Bruevich, A.M.+ 73345
+Bonch-Bruevich, A.M. 73255
Bond, D.J. 71703
+Bond, P.D. 70573
+Bond, P.D. 70620
Bondar, M.V.+ 73333
Bondar, V.M.+ 70060
Bondarenko, V.A.+ 70486
+Bondarenko, V.A. 70483
Bondorf, J.P.+ 70586
+Bondorf, J.P. 70611
+Bondurant, R.S. 71145
Bong Hee Hahn+ 73109
+Bonhomme, G. 71725
Bonhomme, P.+ 71842
Boniecki, M.+ 73304
Bonifacio, R.+ 71133
Boning, K.+ 70628
+Boniort, J.-Y. 71235
Bonnel, A.+ 73268
+Bonner, W.A. 72163
+Bonneville, R. 72806
+Bonnouvrier, F. 72320
Bonometto, S.A. 70342
+Bonwick, W.J. 73415
Boore, D.M.+ 73728
Booth, C.N.+ 70405
Booz, J. *(ed.)* 73669
Bopp, B.W.+ 74075
Borderie, B.+ 70592
+Borderie, B. 70603
Bordon, W.Thatcher *see* Thatcher Bordon, W.
Bordovitsyn, V.A.+ 70304
+Borel, M.M. 72391
Borham, A.H. 74005
Boris, A.Yu. 71536
Borisenko, V.A.+ 73160
Borisenkov, E.P.+ 73908
+Borisova, V.A. 73099
+Borland, D.W. 73229
+Borle, W.N. 72982
Borman, V.D.+ 72600
+Bormann, R. 73030
Borodachev, A.N. 71486
+Borodina, T.V. 72518
Boronin, A.I.+ 72216
Borovoi, V.Ya.+ 71514
+Borrelli, N.F. 73629
+Bortle, J. 74043
+Bortle, J.E. 74052
Borzyak, P.G.+ 71919
+Bosch, A.T. 71869
Bosch, A.Van den *see* Van den Bosch, A.
+Boschi, E. 73748
Bosco, E. 69926
Bose, S.K. 69828
Bose, S.K. 69834
Boser, O. 73123
Bosetti, P.C.+ 70307
Bosse, J.C.Le *see* Le Bosse, J.C.
+Bothum, G. 74046
+Botje, M.A. 70414
Bottcher, A.P. 71001
+Botteau, A.M. 72725
+Boucher, B. 72694
+Bougnot, J. 73439
Boulesteix, C.+ 71974
+Boulos, M.I. 71692
+Boumart, M. 70602
+Bourcrot, J. 70418
+Bourdrez, J. 70677
Bourgeois, M.T.+ 70882
+Bourke, M.A.M. 71939
+Bourkoff, E. 71172
+Bourotte, J. 70418
Bourret, A.+ 71965
+Bourret, A. 71974
Bouthier, M. 71516
Bouyssy, A.+ 70478
+Bowen, H.K. 72387
+Bowen, M.A. 72464
+Bower, D.H. 72259
+Bowie, O.L. 71478
Bowman, K.P. 73909
+Bowyer, S. 74076
+Boxer, L.A. 73563
+Boyarski, A.M. 70399
Boyd, T.J.M. 71744
+Boyd, W.G.C. 71517
+Boyle, B.J. 74178
+Boymel, P.M. 70922
Bozhokin, S.V.+ 71695
Bozis, G. 73977
Brabec, V.+ 70833
+Braccesi, A. 74173
Bracci, L.+ 70425
Bracci, L.+ 70403
+Brada, Y. 72448
Bradberry, G.W.+ 72050
+Bradley, D.J. 71122
+Brady, T.D. 69843
+Brailovskii, E.Yu. 72003
+Brako, R. 72919
Brana, J.+ 70812
Brana, J.+ 70811
+Branchadell, V. 73314
Branco, G.C.+ 70286
+Brandan, M.E. 70607
+Brandan, M.E. 70608
Brandeis, J. 71534
+Brandon, S.L. 71501
+Brandt, A. 73257
Brandt, E.H. 72563
+Brandt, N.B. 72403
+Brashaer, R. 74094
Brat, V.+ 69864
Braun, M.+ 70555
Braun, P.+ 72467
Braun-Munzinger, P.+ 70639
+Braun-Munzinger, P. 70587
+Brazinskii, V.I. 71605
Breatnach, E.+ 73656
+Breault, R.W. 73466
Breazeale, M.A.+ 72055
+Breczewski, T. 72738
+Bredikhin, V.I. 72759
+Bredimas, V. 72587
Breed, C.S.+ 74025
+Breger, P. 70963
+Bregman, T.P. 73219
+Brehm, C. 71235
+Breidenbach, M. 70399
Breizman, B.N.+ 71717
+Brekhovskikh, G.L. 71089
Bremel, R.D.+ 73691
+Brenci, M. 73655
Brendel, C.+ 70572
+Brendel, C. 70587
+Brennecke, P. 70682
+Brennert, G.F. 72395
Bressan, J.D.+ 73136
+Bressani, T. 70584
Breth, A.+ 73393
Breuer, H.+ 70609
Breulet, J.+ 73357
+Brewer, J.A. 73768
Brezin, E.+ 72184
+Brezina, B. 72753
+Brianson, Ch. 70481
+Briant, C.L. 73264
+Brichet, E. 73784
Bricmont, J.+ 72621
Bridger, R.D.E.L. 73279
Brill, D.+ 71270
Brine, D.T.+ 73416
Bringi, V.N.+ 73867
Brink, D.+ 70468
Briones, F.+ 72852
Briskman, B.A.+ 72028
+Brito, L.P. 70473
Brito Cruz, C.H.+ 71141
+Britton, B. 72054
+Brochard, F. 70753
Brocher, T.M.+ 73746
+Brocks, W. 70696
Brodeau, F. 69978
+Brodersen, K. 70674
+Brodersen, S. 70883
Brodin, M.S.+ 72868
Brodin, M.S.+ 72845
Brodowsky, H.+ 73126
+Brody, B. 71206
+Brodzinski, R.L. 70497
+Brodzinski, R.L. 73385
Broeck, C.Van den *see* Van den Broeck, C.
+Broecker, W.S. 73827
Brokaw, A.P. 70062
+Brom, J.M., Jr. 70961
+Bromer, H. 72697
+Bromley, D.A. 70457
+Bronson, J.D. 70618
Brook, R.J.+ 73021
+Brookeman, J.R. 72693
Brooker, M.H.+ 72778
Brooks, R.B.S.+ 69826
Brostow, W. 71608
+Broughton, R. 73556
+Brown, C. 70419
+Brown, C.K. 71319
+Brown, D. 73288
+Brown, D.M. 72477
+Brown, D.P. 70497
+Brown, G. 73012
+Brown, J.L. 73629
Brown, L.D.+ 73768
Brown, M.C.+ 73591
Brown, N.+ 73181
+Brown, N.M.D. 72515
+Brown, P.J. 72610
+Brown, P.J. 72611
+Brown, R. 74043
Brown, R.A. 72068
Brown, R.C. 71643
+Brown, R.E. 70438
Brown, R.G.+ 72292
+Brown, R.H. 74050
+Brown, S.N. 71535
Brown, W.P. 71200
Brown, W.S.+ 73583
+Broyer, M. 70896
+Bruant, J.P. 70660
Bruce, A.D.+ 70011
+Bruce, A.J. 71889
Bruckner, A.+ 71474
Bruinsma, R.+ 72623
Brun, K. 70113
Bruna, P.J.+ 70785
+Bruna, P.J. 70784
+Brundage, W.E. 73063
+Brunet, S. 72997
+Brunne, M. 71105
Brusdeylins, G.+ 72921
+Brussaard, G. 73866
+Bryant, H.C. 73477
Bryant, J. 69875
Bryman, D.A.+ 70371
+Brzhevskaya, O.N. 73543
Buachidze, Z.E.+ 71233
+Bucca, C. 73611
Bucco, D.+ 71433
Buchan, K.L.+ 73711
Buchanan, R.C.+ 72154
Buchek, L.T.+ 73055
+Bucher, J.P. 71927
+Buckles, R.G. 73695
+Buckley, D.H. 73218
+Buckley, D.H. 73228
Bucknall, C.B.+ 72124
Budhani, R.C.+ 72293
+Budzanowski, A. 70562
Budziak, A.+ 70751
+Budzynski, M. 72718
+Buemi, G. 70760
+Buenerd, M. 70607
+Buenker, R.J. 70784
+Buenker, R.J. 70785
Buevich, Yu.A. 73374
Bufetov, I.A.+ 71759
Bugeat, J.P.+ 70146
+Bugg, D.V. 70539
Buhring, W. 70977
+Buijserd, A.N. 70137
Buishvili, L.L.+ 72704
Buishvili, L.L.+ 72656
Bulabois, J.+ 71094
+Bulaevskii, L.N. 72565
Bulanin, M.O.+ 70943
+Bulatnikov, E.I. 73107
Bulavinov, V.V.+ 72526
+Bulavinov, Y.V. 72874
+Bull, M.K. 71538
Bullen, R.B.+ 73499
+Bullough, R.K. 70808
+Bulygin, I.P. 73305
+Bulygin, I.P. 73211
Bum Kim Kwang *see* Kwang Bum Kim
Bunk, B.+ 70212
Bunke, J.+ 72697
Bunkin, F.V.+ 71285
+Bunnenberg, E. 70930
+Bunse, G. 73839
Bunting, K.A. 71808
Burak, F. 70931
+Burdakov, A.V. 71753
Buren, D.van *see* van Buren, D.
Burger, H.+ 70869
+Burger, H. 71888
+Burger, H. 70874
Burgmans, A.L.J.+ 71825
+Burgun, G. 70418
+Burgy, P. 71000
Burilkov, D.T.+ 70413
+Burinov, V.F. 71633
Buritskii, K.S.+ 71232
+Burke, D.L. 70399
+Burke, J.T. 73094
Burkhard, D.G.+ 71171
Burkitbayev, S.M.+ 73689
+Burnett, P.A. 73589
+Burns, E.J.T. 70737
+Burns, P.D. 70909
Burns, R.C.+ 70889
Burq, J.P.+ 70408
+Burrows, D.N. 74184
+Burshtein, A.I. 71849
+Burshtein, A.I. 71850
+Burshtein, E.A. 73528
+Bursill, L.A. 71980
Burton, R.H.+ 71906
+Burtsev, A.A. 73890
Burtsev, V.A.+ 71793
+Burtseva, S.A. 73634
+Bus, E.H. 74053
Bus, S.J.+ 74053
Busalaev, I.V.+ 73851
+Buschmann, J. 70606
+Bushlanov, V.P. 71614
+Butler, J. 73517
+Butler, W.H. 72288
+Buttet, J. 71927
+Butvin, P. 71885
+Butvinskii, A.V. 73633
Butylkin, V.S.+ 71185
+Buyanov, Yu.I. 73066
Buzaneva, E.V.+ 72501
Buzdin, A.I.+ 72565
+Byars, L.G. 70165
Byberg, J.R.+ 72673
Bychenkov, V.Yu.+ 71732
+Bychkov, A.G. 72763
Bykovskii, Yu.A.+ 71707
+Bykovskii, Yu.A. 71760
Bytsenko, A.A.+ 72330
Byung Chan Eu+ 70986
+Byung Chan Eu 70758

+Cacciari, C. 74047
+Cacciatore, M. 70858
Cachau-Herreillat, D.+ 71951
+Cadez, I. 71024
Caer, G.Le *see* Le Caer, G.
+Cagan, V. 72631
+Cai Zengliang 71028
+Cai Zengliang 71031
Cai-ming Wu *see* Wu Cai-ming
Caianiello, E.R.+ 69916
+Calais, J.-L. 69977
Caldi, D.G. 70174
Caldwell, G.+ 73321
Caldwell, J.A.R.+ 74088
+Calemczuk, R. 71913
Caliceti, E.+ 69906
+Calimani, E. 70368
Callaway, J.+ 71017
+Callot, O. 70418
Calogero, F. 69859
+Calvani, P. 72695
Calve, J.le *see* le Calve, J.
Calvet, N.+ 74127
Camassel, J.+ 72317
+Camlibel, B.V. 72163
+Campanini, R. 70414
+Campbell, D. 74052
+Campbell, D.B. 74033
Campbell, E.J.+ 70850
Campbell, I.A.+ 72615
Campbell, J.A.+ 71519
Campbell, J.A.+ 71520
Campillo, A.J.+ 70117
Campo, J.Gomez del *see* Gomez del Campo, J.
+Campos, J. 71020
Candy, J.V.+ 73501
Cannell, D.S.+ 71572
+Cannell, D.S. 71573
+Cannon, W.R. 72387
+Canto, J. 74127
Cao Xiao-wen 72529
+Capaccioli, M. 74001
+Capel, H.W. 69861
+Capellmann, H. 72610
+Capellmann, H. 72611
+Capiluppi, P. 70368
+Capitelli, M. 70858
+Capitelli, M. 71002
Capizzi, M.+ 72435
Caputi, L.S.+ 73387
+Carabelas, A. 72119
Carbucicchio, M.+ 73272
+Carceller, J.E. 72497
+Card, H.C. 72416
+Cardillo, M.J. 72913
Cardinali, G.C. 73461
+Cardon, F. 72732
+Cardona, M. 72302
+Cardona, M. 72363
+Cardona, M. 72807
+Cardona, M. 72754
+Carfagna, C. 73438
Cargill, G.S., III+ 72885
+Cargill, G.S., III 72232
+Caria, M. 70584
+Carinena, J.F. 69912
Carleton, K.L.+ 73005
+Carlfors, J. 72747
+Carlson, B.V. 70640
Carlson, C.E.+ 70352
Carlson, D.E.+ 73003
Carlson, J.+ 70172
+Carlson, T.A. 70952
+Carlson, T.A. 70832
Carlsson, L.+ 73138
+Carmeli, B. 72225
Carmeli, M.+ 70187
+Carmichael, D.C. 73451
+Carpenter, R. 71245
+Carpenter, W.A. 73678
Carpenter, W.C. 71499
Carpentier, R. 73540
Carr, G.L.+ 72547
+Carrasquillo M., E. 70938
+Carre, B. 70963
+Carreira, L.A. 70887
Carroll, J.J. 73913
+Carsky, P. 70836
Carter, A.L.+ 71041
+Carter, J. 70572
Carter, J.A.+ 73747
+Carter, J.R. 70405
Carter, N.L.+ 73790
Carvalho, J.L.S.+ 70441
+Casagrande, F. 71133
+Casali, R. 70368
+Caspers, L.M. 71960
+Casperson, L.W. 71138
+Cassagnou, Y. 70753
+Cassatella, A. 74047
Cassing, W.+ 70599
+Castelain, M. 72694
+Castex, M.-C. 70897
Castle, G.S.P.+ 71832
+Castle, J.A. 73451
+Castleman, A.W., Jr. 71025
+Castro, E.A. 70775
+Castro, E.A. 69931
Cataliotti-Valdina, D.+ 73803
Catanzarite, J.H.+ 70962
+Catravas, G.N. 73641
Cattania, M.G.+ 72237
+Caudano, R. 72248
Cavaliere, A.+ 74174
+Cavalli, S. 73316
Cavanaugh, M.A.+ 73265
+Cavenett, B.C. 72698
Cazzoli, G.+ 70849
+Cazzoli, G. 70854
Cebeci, T.+ 71535
+Cebulka, J.M. 72437
+Cecchetto, E.V. 70700
Cecil, R.A.+ 70561
+Cecil, R.A. 70600
+Cecil, R.A. 70601
Celep, Z.+ 71439
Celli, V.+ 72911
Celmaster, W.+ 70194
+Celotti, G. 72119
+Cercignani, C. 72092
+Ceresa, E.M. 72190
Cerjan, C.+ 70997
Cerjan, C.+ 70998
Cermak, V. 73759
+Cerny, J. 70619
Cerovsky, Z.+ 71056
+Cerrina, F. 72951
+Cerruti, C. 70635
Cevolani, G.+ 74054
+Chachin, O.V. 73019
Chadha, S.+ 70247
+Chaghtai, M.S.Z. 70805
+Chaika, G.E. 72501
Chaing Chen+ 73863
+Chaintreau, M. 72243
Chakrabarti, J. 70382
+Chakrabarty, D.R. 70616
Chakraborty, B.+ 72349
Chakraborty, I.N.+ 72790
Chakraborty, P.+ 72909
+Chakraborty, S.K. 73310
+Challoner, T. 73613
Chamberlain, M.B. 73309
+Chambliss, C.R. 74111

+Chan, I.Y. 70923
Chan, K.S.+ 71483
Chan, S.Y.+ 73154
Chan Eu Byung *see* Byung Chan Eu
Chan F. Lam+ 73675
Chana, G.S.+ 73529
+Chanana, N. 70669
Chand, N. 73120
Chand, S.+ 73172
Chandola, H.C.+ 70326
Chandra, A.+ 71083
+Chandra, D. 72975
+Chandra, R. 71498
Chang, B.+ 70976
+Chang, C.C. 70608
Chang, H.-W. 73222
Chang, J.J.+ 73578
+Chang, J.-S. 71672
+Chang, Y.A. 73070
Chang Ngee-Pong *see* Ngee-Pong Chang
Chang-heng Wang *see* Wang Chang-heng
Chang-lin Guo *see* Guo Chang-lin
Chang-qing Shu *see* Shu Chang-qing
Chao-fan Yu *see* Yu Chao-fan
Chao-guo Wang *see* Wang Chao-guo
+Chapliev, N.I. 71758
Chapman, C.H.+ 73734
Chapman, D.M.F.+ 73802
Chapman, N.R. 73813
Chapman, R.D.+ 74113
Charalambous, S.+ 72877
Charap, J.M.+ 69941
+Charar, S. 72997
+Chari, Y.N. 73204
+Charpentier, Ph. 70418
+Charvet, J.L. 70635
Charwat, A.F.+ 71567
+Chase, L.L. 72862
Chasovnikova, L.V.+ 73516
+Chatley, P.K. 70376
+Chatry, J.P. 72792
Chatterjee, P. 72298
Chattopadhyay, D.+ 72405
Chau, L.-L.+ 70351
+Chau-Chun Lu, N. 72413
+Chaudhuri, K.S. 71584
+Chaudhuri, N.K. 70632
+Chauvin, J. 70607
Chawla, U.S. 71367
+Chekmarev, S.F. 71595
Chekunaev, N.I.+ 72366
+Chemarin, M. 70408
Chemla, D.S.+ 72769
Chemla, D.S.+ 71182
+Chemla, D.S. 72320
+Chen, C.H. 70941
+Chen, C.H. 72130
+Chen, D.T. 73943
+Chen, F.H.K. 71264
+Chen, H.S. 72616
+Chen, L.-H. 70863
Chen, R.Y.+ 71654
Chen, S.H.+ 71096
Chen, S.-H. 71674
Chen, S.-H.+ 73147
+Chen, T.R. 71119
+Chen, W.C. 71654
+Chen, W.F. 71393
+Chen, X.S. 70635
+Chen, Z.D. 72607
Chen An-Ban *see* An-Ban Chen
Chen Chaing *see* Chaing Chen
+Chen Gui-yu 72528
Chen Hao-Lin *see* Hao-Lin Chen
+Chen Jin-zhang 71914
+Chen Ju-fang 72745
Chen Kuo-Mei *see* Kuo-Mei Chen
+Chen Tingjie 72846
Chen Wan-ji 71489
+Chen Xue-xian 72745
+Chen Yi-Heng 71378
Chen Yi-Zhou+ 71378
+Chen Yun-qi 73434
Chen Zhiming+ 72846
Chen Zhuen-xion+ 73312
+Chen-Ping 71427
+Cheng, D.C.-H. 73154
Cheng, S.X.+ 73413
Cheng-cai Si *see* Si Cheng-cai
+Cheng-Chih Pei 70968
Cheng-Lie Jiang *see* Jiang Cheng-Lie
cheng-lu Lin *see* Lin cheng-lu
Cheng-rui Ching *see* Ching Cheng-rui
+Chenlo, F. 73459
Cheon, Il.Tong *see* Tong Cheon, Il.
Cherdantsev, P.A. 70564
+Cherenkevich, S.N. 73538
+Cherepanov, V.M. 73520
+Cherepin, V.T. 72889
+Cherkashin, V.S. 72519
Cherkasov, S.G. 71549
+Cherkesov, L.V. 71577
+Chernavskaya, N.M. 73526
+Chernavskii, D.S. 73526
+Chernaya, L.G. 71344
+Chernik, I.A. 72134
+Chernitskii, Ye.A. 73542
Chernomordik, V.V.+ 74157
+Chernoplekov, N.A. 72064
+Chernov, I.P. 72016
+Chernov, S.A. 71958
+Chernov, Z.S. 73633
+Chernova, N.P. 73893
+Chernyavskii, V.P. 70841
Chernykh, S.I. 69935
+Chernykh, V.A. 71232
+Chernyshenko, I.S. 71390
+Chernyshev, G.N. 71421
+Chernyshov, A.A. 71903
Cherry, M.L.+ 70745
Cherry, M.L.+ 70274
+Cherry, S.M. 73867
+Chertishchev, V.V. 73632
Chertkov, V.A.+ 70906
+Chervonev, L.S. 73133
+Chesnulyavichus, I. 71187
Chestnov, Yu.A.+ 70636
Cheung, T.T.P. 72962
+Chevaleyre, J. 70896
Chevalier, A.+ 73638
Chevalier, B.+ 71942
Chevalier, R.A. 74066
+Chevallier, J. 72861
+Chevallier, M. 70408
+Cheverton, R.D. 70647
+Chew, N.G. 72006
+Chhor, K. 71912
+Chia, C.Y. 71445
Chiang, T.-C.+ 72955
+Chiaretti, G. 72435
+Chiavassa, E. 70584
+Chiba, M. 72800
+Chibisov, G.V. 74197
Chick, L.A.+ 70648
Chien-fan Yu+ 72224
Chien-hua Tsai *see* Tsai Chien-hua
Chien-Shiung Wu 70494
Chih-Yuan Lu+ 72413
+Chihara, H. 70915
+Chikazumi, S. 72306
Chikhachev, A.S. 71065
Childs, W.J. 70924
Childs, W.J.+ 70803
Chin, A.K. 72875
Chin, A.K.+ 72163
Chin, M.R.+ 72502
Chin, S.+ 70956
+Chin, S.L. 71013
Chincarini, G.L.+ 74164
Ching, J.K.S.+ 73859
Ching Cheng-rui+ 70503
+Ching-Yieh Lee 70372
Ching-Zhe zhang *see* zhang Ching-Zhe
+Chino, K. 72498
+Chinowsky, W. 70399
+Chiodelli, S. 70635
+Chirkin, A.S. 71070
+Chirkov, I.V. 71622
+Chirt, V.K. 70428
+Chistyakov, O.D. 72051
Chittineni, C.B. 73917
Chittineni, C.B. 73918
+Chiu, L. 71119
Chiu Ying-Nan *see* Ying-Nan Chiu
+Chizhov, I.V. 73526
+Chizmadzhev, Yu.A. 73537
+Cho, A.Y. 71118
Cho, J.C. 72648
+Cho, J.C. 72775
+Cho, K. 72824
+Choban, E.A. 71695
Choi, S.-il.+ 72343
Choi Sang Don *see* Sang Don Choi
+Cholakov, V.D. 70413
+Chong, D.P. 71040
Chongye Wang *see* Wang Chongye
+Chopra, K.L. 72293
+Chopra, S.C. 73377
+Chou, B.H. 70528
Chou Kuang-chao+ 70177
Choudhury, P.+ 72796
+Choudhury, R.K. 70618
+Choudhury, S.R. 70237
+Choudhury, S.R. 70356
Chow, T.P.+ 72259
Chow, T.P.+ 72258
+Chow, T.P. 72471
+Chow, W.L. 71526
Choy, T.C.+ 72618
+Christel, L.A. 71985
+Christensen, H. 70701
+Christensen, N.E. 72363
Christensen, P.R. 74028
+Christensen, P.R. 70620
Christie, K.W.+ 73712
+Christmann, K. 72237
Christoph, G.H.,+ 71541
Chu, D.+ 73426
+Chu, M.G. 72089
Chuang, S.L.+ 71229
+Chudakov, E.A. 70413
+Chudnovskii, A.N. 71769
Chudoba, T. 72260
+Chuev, M.A. 73520
Chuev, V.V.+ 71929
Chui, S.T. 72085
+Chuistov, K.V. 73085
+Chul-Sung Kim 72164
+Chumachenko, A.F. 72474
Chun-yang Liu *see* Liu Chun-yang
Chung, D.Y.+ 73588
Chung Ok Hee *see* Ok Hee Chung
Chung Yontack *see* Yontack Chung
+Chuprunov, D.L. 70525
Churakova, T.A.+ 70826
+Churpita, A.V. 71506
+Chursin, M.M. 71794
Chutjian, A.+ 71019
+Chvostova, D. 72801
+Chvyrov, A.S. 70413
+Ciampolillo, S. 70368
+Ciangaru, G. 70608
Ciccariello, S.+ 71860
+Cicerone, R.J. 73872
+Ciftan, M. 72292
+Ciofalo, M. 69981
+Cirillo, M. 69981
+Cirone, R. 73965
Ciszek, T.F. 72983
Ciubotariu, C.D.+ 71713
Civitarese, O.+ 70640
Civitarese, O.+ 70439
+Clairon, A. 71162
+Clark, D.H. 74128
+Clark, G.W. 74104
+Clark, J.B. 73042
+Clark, J.B. 73053
+Clark, J.G. 73810
+Clark, J.H. 71163
Clark, N.A.+ 71864
Clark, R.J.H.+ 72065
Clark, T.D.+ 70088
Clark, T.E.+ 70248
+Clarke, C.F. 72050
+Clarke, J.F. 73859
Clarke, J.T.+ 74076
Clary, D.C. 70996
Clauberg, R. 72954
+Clauberg, R. 72948
+Clausen, M. 70946
Clauss, J. 70706
+Clavaguera, N. 71887
Clavaguera-Mora, M.T.+ 71887
Clayton, C.M.+ 70868
+Clayton, E.F. 70307
Cleland, J.H.+ 73249
+Clement, H. 70443
+Clements, R.M. 71805
+Clemesha, B.R. 73953
+Clerc, H.-G. 70641
+Clerjaud, B. 72842
Clifford, S.F.+ 71284
+Clifton, S. 74052
+Cline, J. 73815
Clugston, S.F.+ 73200
Coad, J.P.+ 70650
+Coates, J.-H. 70707
Coatrieux, J.L.+ 73674
Cobb, W.N. 71282
+Cobianu, C. 72786
+Coc, A. 71030
Cocco, G.+ 71900
+Cocke, C.L. 71007
+Codd, M. 70864
Coffee, T.P.+ 73338
Coffey, J.M.+ 70716
+Cogger, L.L. 73921
Cognard, J.+ 71872
Cohen, H.+ 71448
+Cohen, J.B. 73091
Cohen, J.G.+ 74070
+Cohen, L. 71901
+Cohen, M. *(ed.)* 69790
Cohen, M.H. 72295
Cohen, M.H.+ 74176
Cohen, R.+ 69814
+Cohen, R.E. 71909
+Cohen, S.G. 73507
Cohen, S.S. 72735
Cohen, S.S.+ 72477
Cohen, Y.+ 70175
Cohen, Y.+ 70210
Cohen-Sabban, Y.+ 71079
+Coker, J.E. 71242
Colavita, E.+ 72777
Cole, E.A.B. 69877
+Cole, H.S. 70699
+Coleman, D.J. 73648
Coleman, J.E. 72640
Colgate, S.A. 73961
+Collins, A.L.W. 73201
+Collins, D.M. 72852
+Collot, B. 73754
+Colson, J.C. 73246
+Comar, D. 73697
+Combescure, C. 72997
+Comeau, C.P. 70099
+Comes, F.J. 70895
Comfort, J.R.+ 70558
+Cominsky, L.R. 74109
Comminou, M.+ 71399
Comninou, M.+ 71473
+Compain, H. 72842
+Comsa, G. 72920
+Comyn, M. 70539
+Condon, J.J. 74095
+Condrate, R.A., Sr. 72790
+Conforti, G. 73655
Connor, J.N.L.+ 70990
Conrad, R.+ 73839
Consoli, M.+ 70397
Constantinou, M.C.+ 71430
+Conversano, R. 69981
+Cook, A.F. 74052
+Cook, D.R. 73873
+Cook, F.A. 73768
Cook, G.+ 71165
Cook, J.M.+ 71981
+Cook, L.W. 72524
+Cook, L.W. 72404
+Cook, R.F. 73180
+Cooke, D.J. 74095
+Cool, T.A. 71113
Cooper, F.+ 70243
+Copeland, J. 73672
Copeland, R.A.+ 70999
Cordoba, A. 71544
+Coriell, S.R. 72090
+Corke, M. 71249
+Corley, D.M. 71333
+Cormell, L. 70419
+Cormier, T.M. 70622
Cormier, V.F. 73732
+Cornelis, J. 72575
+Cornelison, S.G. 72607
+Cornelison, S.G. 71896
+Cornioley, Y. 70772
+Corti, M. 70383
Cosandey, F.+ 73033
Cosandey, F.+ 73149
+Cosby, P.C. 70865
Cosgrove, T.+ 72147
Costa, G.Da *see* Da Costa, G.
+Costa, S. 70584
+Costain, C.C. 70040
+Costilhes, J.P. 70753
Cotaescu, I.I. 70228
+Cote, P.J. 72373
+Cotton, W.R. 73863
+Cottone, G. 70670
Cottrell, M.J.+ 74132
Coupe, G.M.+ 74042
+Courtillot, V. 73774
+Courtney, S.H. 70939
+Courtney, S.J. 70940
+Cousins, A.W.J. 74088
+Coutures, J.P. 73467
+Couzi, M. 72822
Cova, S.+ 70118
+Cowan, R.D. 71706
+Coward, D.H. 70394
+Cowin, J.P. 72224
+Cowin, S.C. 71402
+Cowley, A.A. 70608
Cowley, J.M. 71844
+Cowling, I.R. 73421
+Cox, A.J. 71163
+Cox, C.R. 71041
+Cox, D.F. 72255
Cox, G.W.+ 73799
+Cox, M. 73675
+Coxon, J.A. 74064
+Crabtree, G.W. 72556
Craig, B.I. 72344
Craig, J.H., Jr. 72211
Craig, J.H., Jr. 72245
+Craig, R.A. 70908
+Craig, R.S. 72641
+Cramarossa, F. 70858
Crampin, M. 70189
+Crandall, E.S. 70419
Crandall, R.E.+ 69907
+Cravens, T.E. 74038
Crawford, J.P.+ 70385
Crawford, W.R.+ 73818
+Crawley, J.C.W. 73660
Crecelius, G.+ 72331
Crecy, A.De *see* De Crecy, A.
Creel, D.+ 73563
Creel, R.B. 70912
Crescenzi, M.De *see* De Crescenzi, M.
Creutz, M. 69997
Creutz, M. 70233
+Crevecoeur, C. 72520
+Crim, F.F. 70999
Crisan, M.+ 72608
+Cristiani, S. 74001
+Crljen, Z. 72923
+Cronquist, A.G. 73660
Cross, J. 73379
+Crozon, M. 70418
+Cruddace, R.G. 74161
+Cruickshank, F.R. 72793
+Cruickshanks-Boyd, D.W. 73014
Cruikshank, D.P.+ 74050
+Cruikshank, D.P. 74043
Cruz, C.H.Brito *see* Brito Cruz, C.H.
+Cserny, I. 70833
+Cserny, I. 72963
+Csih, S.Z. 72890
+Cubeddu, R. 70118
Cullis, A.G.+ 72006
+Cumming, E.W. 71679
Cummings, F.W.+ 71097
Cummings, P.T.+ 71855
Cunat, C.+ 71892
Cunsolo, A.+ 70436
Curkovic, J. 70718
+Curtis, P.R. 70990
+Curzon, F.L. 69824
+Cussenot, J.R. 71725
+Cyrot-Lackmann, F. 71927
Cytron, S.J. 73036
Cyvin, B.N.+ 70844
+Cyvin, B.N. 70843
Cyvin, S.J.+ 70843
+Cyvin, S.J. 70844
Czarnik-Matusewicz, B.+ 70856
+Czermann, M. 72281
+Czeto, A.R. 73562
+Czyzak, S.J. 74136

Da Costa, G.+ 72188
da Silva, A.Ferreira *see* Ferreira da Silva, A.
Da Silva, F.H.Lopes *see* Lopes Da Silva, F.H.
Da-jun Wang *see* Wang Da-jun
Da-ren Pan *see* Pan Da-ren
Dabosi, F.+ 73269
+Dabosi, F. 73268
Dabrowski, C.A. 70723
+Dabrowski, H. 70587
+Dabrowski, R. 72109
Dacol, D.K.+ 73313
+Dadykin, A.A. 71919
+Daehnick, W.W. 70558
Dagan, Z.+ 71637
+D'Agostino, R. 70858
+Dagotto, E. 70363
Dahl, P.H.+ 71288
Dahl, W.+ 70694
Dahmani, B.+ 71162
Dahme, M. 73628
+Dai Guang-xi 70576
Dailun Yang *see* Yang Dailun
+Dakin, J.P. 71245
+Dale, J.D. 71805
+Dalgarno, A. 71008
Dalin, R.A. 73836
+Dallacasa, V. 72075
Dallmeyer, R.D.+ 73755
+Dalu, G.A. 73832
Dam, H.van *see* van Dam, H.
Dam, P.van *see* van Dam, P.
+Dam, R.W. 71646
+Damashek, M. 74095
+Damen, T.C. 72769
+Damjanic, F. 71330
Damm, K.Von *see* Von Damm, K.
Damm, T.+ 70119
Damme, H.van *see* van Damme, H.
Damosso, E.+ 73866
Dance, J.-M.+ 72162
Dandridge, A.+ 71250
+Danelyus, R.V. 70958
Danforth, S.C.+ 73187
Danforth, S.C.+ 73164
+Danforth, S.C. 73238

+Dang, A. 73420
Dangor, A.E.+ 71774
Danicki, E. 72206
+Daniels, R.J. 73664
+Daniels, W.J. 73664
+Danielson, G.E. 74123
Danileiko, M.V.+ 71169
Danilenko, V.M.+ 73068
Danilenko, Yu.K. 71161
+Danilov, A.I. 73806
+Dan'ko, V.A. 73353
Dannemiller, J.L.+ 73572
+Danner, W.F. 71303
+D'Anterroches, C. 71965
Danzmann, K.+ 70821
+Danzmann, K. 70820
Dao-Le Yin .. see Yin Dao-Le
+Darbro, W. 74096
Dardeau, G. 73773
+Darewych, J.W. 71012
Dargel-Sulir, L.+ 71884
+Dariel, M.P. 73370
Darken, L.S.+ 72439
+Darville, J. 72240
Darzi, M.+ 73498
+Das, B. 71383
Das, G. 71995
Das, N.C.+ 71383
Das, N.C.+ 71386
+Das, S. 73457
+Das, S.N. 71383
Dass, G.V.+ 70305
Dass, G.V.+ 70306
Dass, N.D.Hari .....
..... see Hari Dass, N.D.
Date, G. 70318
Date, S.+ 70343
+Datta, K. 70237
+Datta, K. 70356
Datta, N.+ 71545
Datta, T. 70182
+Datta Majumdar, S. .....
..... 69940
+Daub, G.H. 70903
David, P.+ 70631
David, W.I.F. 72101
+Davidenko, N.A. 72591
Davidovic-Ristovski, G.S.+ ..
..... 72312
+Davidovich, R.L. 72668
Davidson, A.+ 70273
Davidson, A.+ 70289
+Davidson, A. 72552
+Davidson, A.M. 72347
+Davidson, E.R. 70791
Davidson, G.+ 70878
+Davidson, I. 70745
+Davidson, K.L. 73880
Davies, H.G.+ 71294
Davies, J.+ 74043
Davies, M.E.+ 74004
Davies, R.+ 73546
+Davies, R.D. 74093
+Davis, B.I. 73100
Davis, H.L.+ 72198
Davis, J.F.+ 73740
+Davis, J.R. 73454
+Davis, R.F. 72989
+Davis, S. 69965
+Davis, T.L. 73777
+Davletgaliev, S.K. 73851
Davoli, I.+ 72776
+Davydov, Yu.M. 71548
+Davydova, N.A. 72845
Dawson, J.M.+ 71743
Dawson, P.H. 73322
Dawson, S.+ 70288
+Day, M.C. 70901
+Dayan, S. 71869
+De, S.K. 73310
de Alti, G.+ 70773
de Beeck, J.op .....
..... see op de Beeck, J.
De Benedictis, S.+ 70858
De Biasi, R.S.+ 72662
+de Boer, F.W.N. 70453
+De Crecy, A. 71965
+De Crescenzi, M. 72887
de Felice, F.+ 69973
de Fornel, F.+ 71238
de Franceschi, G.+ 70446
De Hon, R.A. 74016
de Icaza-Herrera, M. .. 72729
+de Kozak, A. 73074
+de la Vaissiere, C. 70399
De Lillo, S.+ 70199
de Marchi, A.+ 70035
+De Maria, G. 72076
+De Martini, F. 71141
+De Pauw, P. 73449
de Ronzyova, B.+ 71885
+de Roo, M. 69963
de Rosny, G.+ 71824
+De Ruvo, A. 73138
de Saint Simon, M.+ .. 71030
De Saint-Andre, B.+ .. 73754
+de Santignon, P. 70607
de Schepper, L.+ 72884
+de Swiniarski, R. 70635
+de Takacsy, N. 70627
+de Tassigny, C. 70677
de Toledo, A.Szanto .....
..... see Szanto de Toledo, A.
+de Toledo Piza, A.F.R. .....
..... 70527
+de Valera, J. 72820
de Vaucouleurs, G. 74138
de Vaucouleurs, G. 74139
+de Vega, H.J. 72572
+De Vette, G.M.C. 72710
+de Villeneuve, D. 70983
de Vos, R.J. 73658
de Vries, M.S.+ 73327
+de Waard, H. 72720
+de Waard, H. 72721
+de Wit, B. 69963
de Wit, H.J.+ 72520
+de Zwart, S.T. 72920
De-ning Wang .....
..... see Wang De-ning
Dean, K.J.+ 72798
+Dean, R.M. 74042
+Dearnaley, G. 72383
Debnath, S.+ 70267
+Decamp, D. 70418
+Dechko, M.M. 73031
+Decleva, P. 70773
+Decyk, V.K. 71743
Dega-Szafran, Z.+ 73364
+Degli Esposti, C. 70849
Degtyareva, E.V.+ 73046
+Degtyareva, E.V. 73155
Degtyareva, V.V.+ 71569
+Deimel, P. 70690
+Deimel, P.P. 71124
+Dekempeneer, E. 73375
Dekeyser, R.+ 70009
del Campo, J.Gomez .....
..... see Gomez del Campo, J.
+Del Guerra, A. 70752
+del Olmo, M.A. 69912
Delahay, P. 72944
Delbecq, F. 73319
+Delbos, G. 72725
Delbourgo, R.+ 70178
+Delfino, M. 71986
+Delgado-Barrio, G. 70966
+Delgado-Barrio, G. 70992
+Delic, G. 70572
+Deline, V.R. 72000
+Della-Negra, S. 73389
+Dellacasa, G. 70584
Delong, L.E.+ 72536
+Delpierre, P. 70418
+Delunas, A. 69841
+Demas, J.N. 70936
+Demchenko, V.V. 71770
+Dement'ev, L.N. 73208
Demers, S.+ 74150
Demetrius, L. 69989
+Demeyer, A. 70635
+Demidenko, S.G. 71506
+Demidov, A.D. 70483
Demikhovskii, V.Ya.+ .....
..... 72674
+Demin, A.I. 71105
Demochko, Yu.A.+ 72007
Demontis, P.+ 72212
+Demura, A.V. 72022
Demuren, A.O. 71619
Demuth, J.E.+ 72232
+Dem'yanchuk, V.S. .. 71376
den Beukel, A.van .....
..... see van den Beukel, A.
den Bosch, A.Van .....
..... see Van den Bosch, A.
den Broeck, C.Van .....
..... see Van den Broeck, C.
DeNardo, G.L. 73663
+Deng Hui-guo 73434
Denis-Courtois, D.+ 70769
+Denison, A.B. 72724
Denisov, A.G.+ 72488
+Denisov, A.S. 70408
+Dennebouy, R. 72243
+Dennis, B.R. 74058
Dennis, G.R.+ 72764
Dennis, G.R.+ 72765
Denstman, H. 70131
Deo, B.B.+ 70293
Deo, B.B.+ 70295
DePaolo, D.J. 73778
Depierrefixe, C.+ 71950
Deptrit, A. 73972
der Hulst, J.M.van .....
..... see van der Hulst, J.M.
der Merwe, A.J.van .....
..... see van der Merwe, A.J.
der Merwe, J.H.van .....
..... see van der Merwe, J.H.
der Osten, W.von .....
..... see von der Osten, W.
der Velden, G.Van .....
..... see Van der Velden, G.
+Dergobuzov, K.A. 70081
+Derkaoui, J. 70368
DeRosa, F. 70043
Derov, J.+ 72880
Derrida, B.+ 72370
+Dertinger, H. 73643
Deryagin, B.V.+ 71644
Deryuga, V.A.+ 70426
Deryuga, V.A.+ 70427
Deryugina, N.I.+ 70094
+Desai, K. 73485
+Desai, R.C. 71585
Desando, M.A.+ 72734
+Descamps, M. 71882
+Deshmukh, B.T. 71966
+Deslouis, C. 73268
+Deslouis, C. 73269
Desnica, U.V.+ 73414
+Dessagne, Ph. 70445
+Dessokey, M.M. 73724
Dethier, J.-L.+ 70354
Detkov, S.P. 71336
Dette, M.+ 70689
+Dettmann, F. 72553
+Deutscher, G. 70007
+Devaud, G. 71824
Devaud, M.+ 72059
Deveaud, B.+ 72866
+Devi, N.A.L. 70589
Devyatkov, N.D.+ 73633
Dey, B.P.+ 73324
+Dey, S.D. 72909
+Dey, S.S. 71394
+Deza, R. 70363
Dhaliwal, R.S.+ 71475
+Dharmaratna, W.G.D. .....
..... 72456
Dhawan, V.+ 73662
+Dheer, P.N. 72555
+Dhindaw, B.K. 73310
Dhingra, K.+ 73477
+di Lauro, C. 70874
Di Toro, M.+ 70471
Di Vecchia, P.+ 70364
Di Yao-min 70430
Di-sheng Tang .....
..... see Tang Di-sheng
Diadiuk, V.+ 72411
+Diamon, H. 72949
+Dianoux, A.J. 71912
+Dias, M. 73871
+Diaz, G. 70842
+Dibenedetto, A.T. 73237
+Didenko, P.I. 71989
+Dienes, A. 71153
+Dieterle, W.E. 70399
Dijkstra, D.+ 71566
+Dikchyus, G.A. 70958
+Dikshtein, I.E. 72647
+Dillon, J.B. 70399
Dillon, T.M. 73825
+DiMaggio, F.L. 71428
+DiMaria, D.J. 72871
+Dimarogonas, A.D. .. 71331
DiMilia, R.A.+ 73037
Dimitriev, Y.+ 71886
+Dimitrov, V. 71886
+DiNardo, N.J. 72232
Ding, K.+ 70940
Ding E Jiang 69982
Ding Shiying 72562
+Dionne, D. 73443
Dionne, G.F.+ 71593
+Dios, Z. 70144
Diosi, L. 70227
+Disch, R.L. 70790
+Disdier, D. 70575
+Dite, A.F. 72836
Ditl, P.+ 70653
+Ditl, P. 70668
Dittmer, G.+ 73360
Diu, B. 69905
Divakar, P.+ 73224
Dixit, M.S.+ 70384
+Dixit, M.S. 70371
+Dixit, M.S. 71041
+Dixit, V. 74192
Dixon, R.H.+ 71107
Djabourov, M.+ 73376
+Djafari-Rouhani, B. .. 72208
+Djerassi, C. 70930
+Dmitrenko, V.E. 72758
Dmitriev, S.G. 72475
Dmitriev, V.F.+ 70450
Dobes, J.+ 70533
+Dobretsov, G.Ye. 73689
+Dobrowolny, M. 73957
+Dobrozemsky, R. 73393
+Dobrygin, P.G. 70671
+Dobrzynski, L. 72208
+Dobson, D. 73582
+Dobson, E. 72990
Doczi-Reger, J.+ 72571
Doddrell, D.M.+ 70913
+Doddrell, D.M. 70926
+Dodonov, A.I. 72907
+Dodson, G.W. 71041
+Dogadushkin, V.Yu. .....
..... 73175
+Dohmann, H. 70785
Doi, M.+ 70504
+Doi, M. 73064
+Doktorov, A.B. 71849
+Doktorov, A.B. 71850
+Dolganov, L.V. 73908
+Dolgov, V.V. 70671
+Dollery, A.A. 73440
+Dolphin, A.C. 73700
Doman, B.G.S.+ 72619
Domine, F.+ 71893
Domingue, J.A.+ 73079
+Dominguez, D.D. 72371
Dominguez, M.B.Favre .....
.. see Favre Dominguez, M.B.
+Dominguez-Lerma, M.A. ...
..... 71572
Domke, M.+ 72644
Don Choi Sang .....
..... see Sang Don Choi
+Donaldson, G.J. 70419
Dong-ho Lee 71533
Dong-ping Ma .....
..... see Ma Dong-ping
Donnamaria, M.C.+ ... 70775
Donner, J. 73841
Donovan, E.P.+ 72081
Donovan, P.E.+ 71979
+Donovan, R.J. 70934
Dop, H.Van .....
..... see Van Dop, H.
+Dopita, M.A. 74180
+Doraiswamy, L.K. 73363
Doran, J.C. 71539
+Dordzhin, G.S. 72488
+Dore, C. 70408
Doremus, R.H. 73329
+Doremus, R.H. 71889
+Dorfan, J.M. 70399
+Dorikens, M. 72884
+Dorikens-Vanpraet, L. .....
..... 72884
+Dorion, I. 70607
Dorman, C.E. 73884
+Dorn, H.C. 70093
Dorofeenko, V.G.+ 71751
+Dorofeev, V.G. 73255
Dorofeev, Yu.G.+ 72639
+Dorokhov, I.N. 71635
+Doroshkevich, E.A. .. 73031
+Dorri, A. 71097
Dos Santos, M.P.+ 72804
Dostal, J.+ 73756
Dothan, Y. 70388
Dotsenko, V.S.+ 72626
+Dotsenko, V.S. 72626
+Dotsenko, Yu.V. 70552
Doualan, J.L.+ 72772
Douaron, A.Le .....
..... see Le Douaron, A.
+Doubre, H. 70598
+Doughty, D. 73666
+Douglass, G. 74049
Dousse, J.-C.+ 69825
Doussineau, P.+ 72058
Doussineau, P.+ 72061
+Doussineau, P. 72546
Dovbeshko, G.I.+ 72277
Dover, C.B.+ 70480
Dovga, N.D.+ 72815
+Dovgii, V.I. 70081
Dovgii, Ya.O.+ 71217
+Dow, J.D. 72752
+Dow, J.D. 72464
Dowling, A.P. 71537
Dowling, A.P. 71540
+Downing, H.L. 72161
Downs, G.S.+ 74011
+Dowson, D. 73683
+Doyle, D.J. 73676
Dozzi, M. 69980
Draayer, J.P.+ 70434
Drachinskii, A.S. 72039
+Dracoulis, G.D. 70432
+Dragan, V.I. 73209
Drager, U.C. 73565
Dragomir, V.V. 73235
Dragon, R.+ 72876
+Dragoun, O. 70833
+Drake, T.E. 70449
+Drapak, L.S. 72428
Dray, T.+ 70185
Dreicer, H. 71782
+Dreike, P.L. 70737
+Dresselhaus, G. 72781
+Dresselhaus, M.S. 72781
Dressler, A.J. *(ed.)* 69806
Drever, R.W.P. 69971
+Drexhage, M.G. 72838
Dreyfus, C.+ 70860
Driel, J.van . see van Driel, J.
Driel, M.A.Van .....
..... see Van Driel, M.A.
+Driscoll, C.F. 71700
+Driscoll, T.A. 71183
Drish, W.F., Jr.+ 69822
Drolshagen, G.+ 72910
+Drost, H. 73320
+Drouffe, J.-M. 70219
+Drouot, R. 71607
+Drozdov, M.N. 72408
Drozdy, G.+ 71997
+Drucker, D.C. 71398
+Druilhet, A. 73855
+Drumm, P.V. 70563
Drummond, I.T.+ 69862
+Drummond, J. 74046
Drummond, P.D. 69929
+Drummond, R. 73734
Druskin, V.L. 73717
Drzewiecka, M.A.+ 71305
Drzezla, B.+ 73725
Du, P.le ..... see le Du, P.
+Duane, S. 69862
+Dube, D.C. 72742
Dube, L.J. 71005
+Dube, S.K. 73804
+Dubin, D.L. 70394
+Dubois, J.E. 70884
+Dubois, J.M. 71892
+Dubois, R. 70371
Dubosclard, G.+ 73855
+Dubov, V.V. 72899
Dubovoi, E.I.+ 70547
Dubreuil, B. 71003
Dubrinin, V.V.+ 71356
Duchs, D.+ 70725
+Duck, I. 70462
+Duck, R.W. 73849
+Ducloy, M. 71201
+Ducros, R. 72241
+Dudin, A.D. 74009
+Duek, E. 70595
+Duek, E. 70578
Duffy, D.M. 71380
Duffy, J.+ 73010
Duffy, R.M.+ 70104
Duflos, F.+ 73118
+Duhaj, P. 71885
+Duijvestijn, M.J. 72710
Duke, C.B.+ 72203
Duley, W.W. 69807
+Duling, I.N., III 71136
+Dumond, Y. 72956
Duncan, J.L.+ 70765
Duncan, M.J.+ 74140
Duncanson, J.A., Jr.+ .....
..... 73325
+Dundurs, J. 71473
+Dunford, D.W. 70731
Dunlap, B.I.+ 70774
Dunmur, D.A.+ 71851
+Dunnweber, W. 70623
+Dunscombe, P.B. 73651
+Dupak, Ya. 70426
+Dupont, Ph. 71235
+Duprat, M. 73268
+Duprat, M. 73269
Dupre, B.+ 73764
+Dupui, Ph. 73670
+Duran, P. 72156
Durand, B.+ 70315
+Durand, L. 70315
+Durand, M. 70610
Durga Prasad, K.A.+ . 70067
+Durhuus, B. 70364
Durney, B.R. 73984
Dutchak, Ya.I.+ 72888
Dutoit, M. 72995
+Dutt, V. 72163
Dutta, A. 70234
Dutta, N.K.+ 71124
Dutta, R.+ 72261
+Dutta, S. 73324
Duval, P.D.+ 70435
+Duval, P.D. 70492
+Duvivier, C. 73620
Dvorak, L. 74101
+Dvorkin, B.A. 72750
+Dwarakadasa, E.S. 73098
+Dwarakadasa, E.S. 73227
Dwight Luker, L.+ 71319
+Dyadyusha, G.G. 70958
D'yakonov, M.I.+ 72844
+Dye, R.H., Jr. 73597
Dyer, I.+ 73786
+Dyer, P.E. 71165
+Dyke, J.M. 70945
Dymarz, R.+ 70448
Dymenko, S.K.+ 71632
Dynes, R.C. 72341
+Dyubko, S.F. 70855
+Dzhalilov, S.T. 72219
Dzhioev, R.I.+ 72705
+Dzhishkariani, O.S. ... 73535
+Dzhordzhadse, V.P. ... 70413
+Dziedzic, P.J. 73384
Dziesiaty, J.+ 72511
Dzuba, V.A.+ 70794
Dzwig, P. 72351
Dzyaloshinskii, I.E.+ .. 72629
Dzyuba, A.S. 72186
+Dzyublik, A.Ya. 72723

E Jiang Ding .....
..... see Ding E Jiang

e Silva, J.Andrade *see* Andrade e Silva, J.
+Eartly, D.P. 70409
East, B.W. 73661
+Eastman, D.E. 72955
Eatah, A.I.+ 72534
+Eaton, D.R. 70904
+Eaton, D.R. 70905
+Eaton, G.R. 70922
Eaton, J.A. 74105
+Eaton, M.W. 70399
Eaton, S.S.+ 70922
+Ebbesmeyer, C.C. 73820
+Eberhardt, W. 72967
Eberhart, M.E.+ 72091
Eberlein, D.+ 71220
+Ebert, H.G. *(ed.)* 73669
Ebert, W. 71811
+Eckhause, M. 71041
Ecob, R.C.+ 71845
+Ecob, R.C. 71846
Edeleanu, C.+ 73247
+Edeleanu, C. 73249
+Ederer, D. 70829
+Edgington, J.A. 70539
Edmond, J.M.+ 73765
+Edmonds, D.V. 73089
Edmonds, I.R.+ 73421
Edwards, P.L. 71293
+Efendiev, T.Sh. 71187
Efetov, K.B. 72287
Efetov, K.B. 72566
Effelsberg, E.+ 71664
+Effenberg, G. 72118
+Efimovskii, S.V. 71142
Efrima, S. 73341
+Efros, A.L. 72135
+Efthimion, P. 71729
Egerton, R.F.+ 70154
Eggen, O.J. 74078
Eggen, O.J. 74079
Eggen, O.J. 74120
+Egorov, F.F. 73028
Egorov, V.D.+ 72836
Eguchi, Y.+ 70644
Eichhorn, H.+ 73999
Eichler, J.+ 71009
Eichler, J.+ 71010
Eickmans, J.+ 72961
+Eigenwillig, G.G. 70682
+Eisenberger, M. 71368
Eisenblatter, J.+ 70693
Eisenmann, B.+ 71948
+Eisenstein, G. 71135
+Ekejiuba, I.O.C. 72785
+Ekelof, T. 70408
+Eklund, P.C. 72536
+El Essawy, M.M. 72388
el Ghadraoui El Houssine *see* El Houssine el Ghadraoui
El Houssine el Ghadraoui+ 71928
El Wakil, S.A.+ 71072
El-Batanouny, M.+ 72952
+El-Bayoumi, O.H. 72838
+El-Farra, M.A. 71761
El-Halim, S.Akbd *see* Akbd El-Halim, S.
+El-Labany, H.M. 72525
El-Nadi, M.+ 70554
+El-Nadi, M. 70560
+El-Naghy, A. 70554
El-Sabaa, F.M. 73973
El-Sabh, M.I.+ 73824
El-Salam, F.Abd *see* Abd El-Salam, F.
+El-Sayed, H.A. 73253
+El-Sharkawy, S.A. 70560
Elayi, A.G. 73386
+Elbaum, M. 73648
Elber, R.+ 70967
+Eldridge, J. 73244
Elekes, P.P. 72993
Elerman, Y.+ 71935
+Elias, J.E. 70394
Elias, J.H.+ 74090
Eliel, E.R.+ 70797
+Elitzur, S. 70175
+Elliot, J.L. 74036
+Ellis, D.D. 73802
Ellis, D.T.+ 73991
Ellis, J.+ 70369
Ellis, J.+ 70378
+Ellis, M. 72118
+Ellis, R.J. 73455
Ellison, F.O. 70799
Ellsworth, R.W.+ 73963
Ellwanger, U. 70260
Elmer, T.H. 73017
+Eloff, P.C. 73152
+Elschner, B. 72670
Elsden, A.D.+ 70664
+Elsner, R.F. 74096
Elson, J.M. 71069
+Elston, R. 74110
+Elton, R.C. 71107
Ely, J.F.+ 71681
Elze, H.-Th.+ 70316
+Elze, Th.W. 70451
+Embury, J.F. 73922
+Emerson, R.G. 73608
Emery, R.J.+ 74125
+Emets, Yu.P. 72470
+Emme, J.J. 73777
Emren, A.T.+ 73432
En-dong Shi *see* Shi En-dong
+Endo, H. 71861
Endo, T.+ 70078
Endo, Y.+ 71861
+Endo, Y. 70851
Engdahl, E.R.+ 73930
Engel, T. 72912
+Engel, T. 72204
Engelman, R., Jr.+ 70816
Engelmann, E. 71818
+Engelmann, F. 70725
+England, J.B.A. 70563
+Engler, G. 70634
+Ennis, J.F. 70457
Enokiya, H.+ 72684
+Enright, G.D. 71763
+Entezami, F. 70539
Entin-Wohlman, O.+ 72541
+Epherre, M. 71030
Ephraim, A.B.+ 72462
Epicier, T.+ 73087
+Epifanova, V.I. 71565
+Epp, V.Ya. 69903
+Epperlein, P.W. 72550
+Eppich, J. 71550
Epshtein, E.M. 72453
Epshtein, E.M. 72490
+Epstein, M. 71448
+Er-Chang Shang 71276
+Erbert, G. 70807
+Ercoli, R. 70781
+Erdogan, F. 71482
Eremenko, V.N.+ 73066
+Eremenko, V.V. 70121
+Eriksen, D. 70595
Eringen, A.C. 71396
+Erken, M. 73394
Erlandson, A.C.+ 71113
Ermakov, V.N.+ 72301
Ermakov, V.N.+ 72328
+Erman, L.A. 71553
Ermolenko, A.S. 72634
Ermolov, V.I.+ 70139
+Ern, V. 72847
+Erne, F.C. 70414
+Ernst, H. 70638
Ernst, N.+ 72238
+Ero, J. 70552
Eroshenko, V.M.+ 71525
Errington, M.L.+ 73700
+Ershov, A.V. 71525
Ershov, V.M 73080
+Ershov, V.P. 72759
+Ershov, V.S. 72848
Ersoy, Y. 72365
Erstfeld, T.E.+ 72264
+Ertl, G. 72237
+Ertl, G. 72938
+Ertl, G. 72226
Erukhimov, M.Sh. 72590
+Erwin, R.W. 72616
+Escher, C. 72078
Escobar, C.O.+ 70244
Esdaile, J.D. 73073
Esmael, F. 69812
+Esnouf, C. 73087
Esposti, C.Degli *see* Degli Esposti, C.
Essawy, M.M.El *see* El Essawy, M.M.
+Esteva, J.-M. 72886
+Estigneev, V.V. 72431
Eswaran, M.S.+ 70616
Eto, M.+ 73167
+Etourneau, J. 71942
+Etsin, S.S. 71958
+Eu, V.K. 72265
Eu Byung Chan *see* Byung Chan Eu
Eustathopoulos, N.+ 72182
Evangelisti, F.+ 72356
+Evans, C.A., Jr. 72000
+Evans, D. 72911
+Evans, D.S. 73955
Evans, G.+ 73864
Evans, G.J. 71863
Evans, G.T. 73326
Evans, H.E. 73259
Evans, J.C.+ 72657
+Evans, J.C., Jr. 70497
Evans, J.H.+ 71960
Evans, J.R.G.+ 73040
+Evans, M.E. 73780
Evans, M.W. 71854
+Evdokimov, O.B. 70081
+Everhart, E. 74043
+Everhart, E. 74046
+Everhart, E. 74051
Evernden, J.F. 73738
Evers, J.+ 71940
+Eversman, W. 71277
Evseev, A.V.+ 70875
+Ewer, K.P. 70878
Eyler, E.E.+ 70795
+Eylon, B. 69814
+Eylon, D. 73152
+Ezawa, H. 70191

F. Lam Chan *see* Chan F. Lam
Fabbri, M.+ 72300
+Fabricius, J. 74049
+Fabrikant, V.I. 71480
+Fabrikov, S.P. 72483
Fabris, D.+ 70744
+Faccini-Turluer, M.L. 70368
+Facq, P. 71238
+Fadley, C.S. 72964
Faessler, A.+ 70460
+Fahrig, W.F. 73711
+Fahrig, W.F. 73712
+Fainberg, Ya.B. 70732
Fakolawala, A.B.+ 70066
+Falciai, R. 73655
Falciglia, F.+ 70096
+Falco, C.M. 72554
Falcon, C.A. 71006
+Falconer, J.L. 72191
+Fal'ko, G.L. 71990
+Falomkin, I.V. 70751
+Fam Le Kien 71099
Fan, G.-Y.+ 70575
+Fan, L.T. 71629
Fan Fu-qun 73165
Fang, M.T.C.+ 71827
Fang Li-zhi+ 74188
Fang Tong 69865
Fangyong Shi *see* Shi Fangyong
+Fanjaud, G. 73670
+Fantechi, R. 70368
+Fantozzi, G. 73207
+Farag, B.S. 72388
Fariabi, S.+ 73201
+Faris, S.M. 72552
+Farmer, C.L. 73777
+Farrelly, D. 70990
+Farrenq, R. 70983
+Fassnacht, P. 70584
+Fateeva, L.N. 70530
+Fauchais, P. 71692
+Fauci, A.S. 73563
Faughnan, B.W.+ 72438
Faulkner, D.R.+ 74115
+Faure, J.C. 70672
+Fauve, S. 71518
+Favart, D. 70414
+Favero, P.G. 70849
+Favre Dominguez, M.B. 71774
+Fay, J. 70408
Fazal-e-Aleem+ 70411
Fearn, D.R.+ 73720
Fearn, D.R.+ 73721
+Fechter, L.D. 73699
Feder, R.+ 72584
+Feder, R. 71014
Federle, G.+ 72060
+Fedorchenko, A.M. 71990
Fedorchenko, I.M.+ 73157
+Fedorov, N.F. 72969
+Fedorov, V.A. 70048
+Fedorov, V.B. 71759
+Fedorova-Koval, E.P. 70542
+Fedoseenko, S.I. 72495
+Fedoseev, D.V. 71644
Fedosyuk, A.F.+ 73404
+Fedotov, M.A. 73208
Fedotov, V.G.+ 72763
+Fedotova, I.M. 71877
+Fedotova, Z.I. 69890
+Feenstra, R.M. 72865
Fehrenbach, G.W.+ 72321
Fei Zhang Ui *see* Ui Fei Zhang
+Feierberg, M.A. 74133
+Feig, S. 70136
Feigelson, E.D.+ 74069
+Feigerle, G.S. 70947
+Feinberg, J. 71192
+Feinendegen, L.E. 73637
Fekel, F.C., Jr.+ 74108
Felderhof, B.U. 71858
Felderhof, B.U. 71859
+Feldmaier, D.A. 71264
+Feldman, G.J. 70399
+Feldman, P.D. 74050
+Feleppa, E.J. 73648
Felice, F.de *see* de Felice, F.
+Felippa, C.A. 71295
Feller, D.+ 70791
+Fellers, C. 73138
+Felsen, L.B. 73807
+Felsen, L.B. 73808
Felstead, D.K.+ 71836
Feltz, A.+ 72726
+Femelat, B. 70896
Feng, M.+ 72265
+Feng Ze 71031
+Fenimore, C. 72090
+Feola, J.M. 73644
+Ferencei, J. 70541
+Ferguson, R.L. 70597
+Ferguson, W.G. 71502
+Ferland, R. 73705
+Fernandez, B. 72176
+Fernandez, F. 70460
Fernandez, F.M.+ 69931
+Fernandez, F.M. 70775
+Fernandez, M. 71848
Fernandez, M.P.Herrero *see* Herrero Fernandez, M.P.
+Fernandez, R.B. 71048
Ferrante, J.+ 72339
Ferreira, C.M.+ 71823
+Ferreira da Silva, A. 72300
Ferrell, W.R.+ 70941
+Ferziger, J.H. 71532
+Festou, M. 74047
+Feth, L.L. 73596
+Fetterman, H.R. 71593
+Feulner, P. 72236
+Fewell, M.P. 70441
Feyssinet, J.-M.+ 73523
Fields, C.A.+ 70453
+Filimonov, E.A. 70542
Filippov, G.A. 72117
+Filippov, V.N. 70128
+Filippov, Yu.P. 71633
Findlay, J.W.+ 73994
+Fing Ze 71028
+Finger, M. 70426
+Finger, M. 70427
+Finger, M. 70485
+Finger, M. 70541
+Fink, D. 71194
+Fink, J. 72331
Fink, U.+ 74034
+Fink, U. 74133
+Finkelstein, P. 73864
Finken, K.H.+ 71773
+Finnie, I. 71494
+Fiore, N.F. 73265
+Fiorentini, G. 70403
+Fiorentini, G. 70425
+Fiorini, E. 70383
+Fiorini, E. 70499
+Fiorini, P. 72356
+Fiory, A.T. 72548
Firsov, E.I.+ 70111
Fischbeck, H.J.+ 69803
+Fischbeck, K.H. 69803
+Fischdick, H. 70691
Fischer, E.+ 70691
+Fischer, J. 72436
Fischer, K.H. 72625
+Fischer, M. 72055
+Fischer, R. 72482
+Fiser, M. 70833
Fishbane, P.M.+ 70355
+Fisher, A. 71775
Fisher, D.S. 72378
Fisher, M.E.+ 72087
+Fisk, Z. 72533
+Fitton, B. 74125
+Fitzer, J. 73426
Fitzgerald, G.+ 70789
+Fitzgerald, J.F. 71593
Fiziev, P.P. 69908
+Flambaum, V.V. 70450
+Flambaum, V.V. 70794
+Flaminio, V. 70368
Flatau, C. 71237
Flavell, R.G. 73903
+Fleischhauer, J. 73126
+Fleisher, V.G. 72705
+Fleisher, V.G. 72706
+Fleisher, V.G. 72708
+Fleisher, V.G. 72707
+Flemings, M.C. 73094
+Flemings, M.C. 72089
+Flerov, M.N. 73555
Fletcher, E.A.+ 73410
+Fleurov, V.N. 72366
Fleury, C.+ 71352
+Flewitt, P.E.J. 73112
+Flom, S. 70940
+Flomenblit, Yu.M. 73082
Florenskii, K.P.+ 74008
Florio, S.M.+ 73266
Flume, R. 70173
+Flynn, C.P. 72829
+Flynn, E.R. 70438
+Flyvbjerg, H. 70249
Foda, O.E. 70281
+Fodor, Z. 70552
+Fois, E.S. 72212
Foldeaki, M.+ 73116
Folds, D.L.+ 71263
Folland, N.O.+ 69823
+Folman, M. 72462
+Fomenko, A.M. 70413
+Fomin, S.I. 71142
+Fomin, V.K. 71759
+Fomin, V.N. 71548
Fonesca, L.+ 72816
+Fong, R. 74178
Fontaine, G.+ 74081
+Fonteneau, G. 72838
Forchel, A.+ 72436
+Forchel, A. 72322
+Forchel, A. 72434
+Ford, P. 74052
+Forest, I. 70592
+Forest, I. 70603
Fork, R.L.+ 71148
Fornel, F.de *see* de Fornel, F.
+Forni, A. 74052
Forster, F. 73296
Forster, H.+ 71803
+Fort, A. 72847
Forthmann, R.+ 72165
+Fortov, V.E. 71735
+Fortunato, G. 72356
Fossum, J.G.+ 72414
Foster, J.S.+ 71318
+Foti, A. 70436
Foukal, P.+ 74062
+Foulds, K.W.H. 71247
+Foulon, M. 71882
Fountain, W.F.+ 74130
+Fourcade, R. 71951
+Fournier, J. 70800
+Fousek, J. 71871
+Fowler, L.A. 74062
Fowler, T.K. 71785
+Fraiman, A.A. 71766
Fraitova, D. 72679
Frampton, P.H.+ 70192
Frampton, P.H.+ 70193
Frampton, P.H.+ 70262
+Frampton, P.H. 70200
Franceschi, G.de *see* de Franceschi, G.
Francfort, G.+ 71392
+Franciosi, A. 72777
Francis, H.A. 71490
Francis, H.A. 71496
Francis, P.W.+ 74021
Francis, R. 73252
Franck, J.P.+ 72179
Franco, E. 70335
Franco, M.A.Alario *see* Alario Franco, M.A.
+Francois, J. 72026
+Francois, P. 71235
+Frank, A. 70433
Frank, B.+ 70012
Frank, D.J.+ 72552
Frank, T.C.+ 72191
Frankel, J.I.+ 71381
+Frankel, J.I. 71382
+Franken, A.J.J. 71222
+Franklin, M.E.B. 70399
Fransen, F.+ 72732
+Franzen, D.L. 71236
Frasca, P.+ 70136
+Frascaria, N. 70598
+Fraser, H.L. 73025
+Fraser, N.M. 73398
+Frauenheim, T. 72595
+Frayne, J.M. 73672
+Fraysse, L. 70753
+Frazer, L.N. 73747
+Freda, G.N. 73711
+Freed, K.F. 72333
+Freedman, B. 70243
Freedman, D.Z.+ 69966
+Freeman, J.R. 70737
Freeman, W.S.+ 70638
Freiberg, A.+ 70124
+Freiman, S.W. 73273
French, H.B.+ 74171
+French, P.M. 70713
+French, R.J. 73539
Frey, H.+ 74020
+Freyhardt, H.C. 73030
Friar, J.L.+ 70551
+Friberg, A.T. 71190
+Fridkin, V.M. 72739
Fried, I. 71365
+Fried, J. 74156
+Fried, T. 70555
+Friedman, J.I. 70394
Friedman, W.A.+ 70535
+Friedman, W.A. 70605
+Friedrich, D. 70940
+Friedrich, D.M. 70939
+Friedrich, R. 71651
+Frigerio, A. 70241
Frignani, A.+ 73250
Frigo, N.J. 71149
Frischbier, R. 69874
+Frit, B. 71950
+Frith, R.A. 73711
+Fritz-Niggli, H. 73642
+Fritze, P. 70307

+Fritzemeier, L.G. 73203
Frobrich, P.+ 70610
+Frodesen, A.G. 70368
+Froes, F.H. 73152
+Frogel, J.A. 74090
+Frohlich, C. 73912
+Frohlich, F. 73302
Frolov, O.S.+ 72483
+Fronsdal, C. 69960
+Frova, A. 72435
+Frova, A. 72356
+Fruchart, D. 72133
Fu Gao Tain .... see Tain Fu Gao
Fu King-Sun .... see King-Sun Fu
Fu Pan-ming+ 71188
Fu-bao He ...... see He Fu-bao
Fu-Goul Yee 70204
Fu-qun Fan ... see Fan Fu-qun
Fu-sheng Jin .... see Jin Fu-sheng
+Fu-Shih Pan 71698
Fu-Tai Liou+ 72444
Fuchs, E. 73390
+Fuchs, G. 70596
+Fuding Ma 71895
+Fueki, K. 73346
+Fueloep, K. 71134
+Fuess, H. 71935
Fuggle, J.C.+ 72886
+Fuhlrott, H. 70697
Fuhrmann, J.+ 71055
+Fuji, Y. 70190
+Fujii, K. 70374
+Fujimoto, J.-I. 71328
+Fujimoto, S. 71078
+Fujimoto, Y. 70280
Fujioka, H.+ 70158
Fujioka, H.+ 70156
+Fujisawa, T. 73948
+Fujishita, H. 72544
Fujita, H.+ 71977
Fujita, K. 71925
+Fujita, M. 70935
Fujita, S.+ 72527
+Fujiwara, H. 71837
+Fukami, T. 73947
+Fukao, M. 71797
+Fukshansky, L. 73631
+Fukuda, H. 73472
+Fukuda, S. 73346
Fukuda, T.+ 70593
Fukumoto, A.+ 71329
Fukutome, H.+ 72289
Fuld, K.+ 73577
Fullam, H.T. 70705
+Fuller, M. 73719
+Fulmer, C.B. 70597
Fulton, B.R.+ 70622
+Fumagalli, G. 73260
+Fumagalli, G. 73261
+Funcke, W. 73493
Fung, P.C.W.+ 69898
+Fung, S.Y. 70585
+Funnell, J. 73590
+Furer, A.L. 71042
+Furer, V.L. 71042
Furlan, P.+ 70218
Furneaux, R.C. 73281
+Furniss, I. 74125
+Fursei, G.N. 72969
Furth, H.P. 71776
Furth, H.P. 71783
+Furubayashi, E.-I. 73202
+Furukane, U. 71689
+Furukoshi, M. 72263
+Furukoshi, M. 72509
+Furuno, R. 71890
+Furuya, T. 70080
+Furzikov, N.P. 70875
Fusong Jiang .... see Jiang Fusong
Fustoss, L. 71657
Fustoss, L.+ 72933
+Futrell, J.H. 71025
Fuxi Gan .... see Gan Fuxi
+Fyfe, W.S. *(ed.)* 69784
Fyk, J. 71315

+Gabart, R. 74094
+Gabel, C.W. 71136
+Gabel, C.W. 71226
Gabov, S.A.+ 71575
+Gabriagues, J.-M. 71235
Gabrusenok, E.V. 72067
+Gabuda, S.P. 73527
+Gabuniya, G.D. 73535
Gabutti, B. 69891
+Gaditsky, V.G. 70542
+Gadmashi, Z.P. 72751
+Gagarin, A.P. 73255
Gai, M.+ 70457
Gaiduk, A.V.+ 69969
+Gakh, G.I. 70395
+Gal, A. 70480
+Gal, J. 70143
Galanov, B.A. 71492
+Galin, J. 70592
+Galin, J. 70603
+Galkin, B. 70136
Galkin, G.N.+ 72512
+Gallagher, J.P. 73171
Gallagher, T.F.+ 70827
Gallawa, R.L.+ 71236
+Gallerano, G.P. 72839
+Galliano, P.G. 70041
+Gallio, M. 70584
Galloway, J.N.+ 73868
+Galotti, K.M. 73606
+Galperin, A. 70709
Gamari-Seale, H.+ 72587
+Gamba, A. 70781
+Gamba, A. 72212
+Gamba, D. 70368
Gambke, T.+ 72670
+Gammampila, K. 73651
Gammon, R.H.+ 73815
Gamo, T.+ 73487
+Gamp, A. 70598
+Gan Fuxi 72746
+Ganbaatar, N. 70507
+Gandhi, O.P. 71180
Gandhidasan, P. 73419
+Gandois, B. 70418
+Ganguli, S. 73626
Ganguly, S.+ 72782
+Ganiel, U. 69814
+Gannon, R.P. 73588
Gao, Y.C.+ 71469
Gao Tain Fu .... see Tain Fu Gao
Gao Yu-Chen+ 71397
+Gaodu, A.N. 73155
+Gaoyuan 71278
Gaponov, S.V. 72256
Garadzhaev, A. 71576
Garbassi, F.+ 72190
Garcia, A.+ 70391
Garcia, J.+ 72133
Garcia, N.+ 72925
Garcia, R.+ 72741
Garcilazo, H. 70475
+Gardes, D. 70592
+Gardes, D. 70603
+Gardner, J.S. 73795
+Garg, H.P. 73471
+Garg, H.P. 73420
+Garg, S.B.L. 73172
+Garg, U. 70614
+Garg, U. 70618
+Garg, V.K. 71465
Garifullin, F.A.+ 71556
+Garland, C.W. 72107
+Garland, J.C. 72547
+Garlinskii, R.N. 71389
+Garmire, G.P. 74180
+Garnier, E. 71947
+Garoff, S. 72784
+Garrett, J.D. 70442
Garrett, M.H.+ 71198
+Garriga, R.A. 73231
Garrison, W.M.+ 73231
+Garron, J.P. 70598
+Gartsman, K.G. 72352
+Garuccio, A. 70096
+Gary, G.A. 74130
+Gasiorowicz, S.G. 70355
+Gatlin, J.A. 73852
Gatto, R.+ 70257
+Gatty, B. 70592
+Gatty, B. 70603
+Gaubert, C. 71841
Gaubert, G.+ 72476
+Gaul, G. 70621
+Gaul, G. 70594
+Gaul, G. 72917
+Gaunaurd, G.C. 71270
+Gaunaurd, G.C. 71271
+Gaunt, D.S. 70008
Gauron, P.+ 70417
+Gauthier, Y. 72476
+Gauthier, Y. 71841
+Gauvin, W.H. 71809
+Gavin, D. 72838
Gavoille, G.+ 72609
Gavrilov, B.G.+ 72015
Gavrilov, V.V.+ 71958
Gavrilyuk, V.G.+ 72716
+Gavrintsev, S.V. 70152
+Gazzaly, M.M. 70447
+Gazzillo, D. 71860
+Ge, X.S. 73413
Ge Lin-xiao+ 70565
Gebala, S.+ 70107
+Gebela, S. 72857
Gebhardt, W. 70692
Gecha, V.Ya.+ 71455
Gedcke, D.A.+ 70165
Geers, T.L.+ 71295
+Geesaman, D.F. 70638
+Geevers, F. 70676
+Geffert, M. 74043
+Geffert, M. 74046
+Geich-Gimbel, C. 70307
Geisler, C.D.+ 73592
Geisler, D.+ 73998
+Geiss, V. 71883
+Geissler, E. 73373
Geissman, J.W.+ 73788
Geissman, J.W.+ 73715
Gekelman, W.+ 71699
Gekker, I.R. 71739
Gelb, D.J.+ 73576
+Gelbcke, M. 70917
Gelbke, C.K. 70566
+Gelbke, C.K. 70604
+Gel'd, P.V. 71932
+Gel'd, P.V. 72402
+Gelee, M. 70707
+Gelfand, E.T. 73582
+Genchev, V.I. 70413
Geneux, E. 70822
Geng, R.S.+ 72054
Genkin, S.A.+ 71810
Genkin, V.M.+ 72489
+Genkin, V.N. 73344
+Gentle, C.R. 73683
+Gentle, I.R. 72764
+Gentle, I.R. 72765
+Gentry, W.F. 70971
+Gentsov, D. 72423
+Genzel, R. 74135
+Geoffroy, M. 70772
+George-Taylor, M. 70862
Georgiev, M.N.+ 73175
+Georgiev, P.G. 69895
Georgii, H.W. *(ed.)* 69791
+Georgii, H.-W. 73869
Georgii, H.-W. *(ed.)* 69792
+Gerard, J.-M. 70286
+Gerasimenko, N.N. 72002
+Gerber, R.B. 70967
+Gerber, R.B. 72914
Gerdjikov, V.S.+ 69857
Gerdt, V.P.+ 70362
Gergely, G. 72898
+Gergely, G. 72761
Gerhard-Multhaupt, R. 70086
+Gericke, K.-H. 70895
Gerl, J.+ 70451
Gerlach, U.H. 69947
+Gerritsen, H.J. 71183
Gersch, H.U.+ 70455
Gershuni, G.Z.+ 71547
Gersten, J.I. 72461
+Gersten, J.I. 72784
+Gerstl, S.A.W. 73922
+Gertsman, V.Yu. 71972
+Gervais, F. 71800
Gerwin, H.J. 73460
Gerzanich, E.I.+ 72739
+Geschka, H. 70959
+Geshkov, I.M. 70413
+Geske, A.Yu. 72433
+Gesland, Y. 72055
Gessert, G.+ 70813
Gessner, T.+ 72389
+Geszti, O. 72280
Geszti, T. 71897
+Gettrust, J.F. 73746
Ghadekar, S.R.+ 71966
Ghadraoui El Houssine el .... see El Houssine el Ghadraoui
Ghazali, A.+ 72291
Ghikas, D.P.K. 69991
Ghodgaonkar, A.M.+ 70984
+Ghodgaonkar, A.M. 70981
+Ghosal, A. 72405
Ghosh, B.+ 71584
+Ghosh, B. 72796
Ghosh, D. 70514
Ghosh, D.K.+ 70509
+Giacomelli, G. 70368
Giacomo, P. 70029
+Giallongo, E. 74174
+Giallorenzi, T.G. 71250
+Giansiracusa, G. 70471
+Gibbons, G.W. 69966
Giber, J.+ 72932
+Giber, J. 72933
+Giber, J. 72210
Gibowicz, S.J.+ 73723
+Gibson, B.F. 70551
+Gibson, D.M. 74107
+Gibson, J. 74043
Gibson, J.M.+ 72130
+Gibson, J.M. 72992
Gibson, N. 71052
Gicquel-Mayer, C.+ 71949
+Gidal, G. 70399
+Giehl, H. 73839
+Gierasch, P. 74027
+Giese, C.F. 70971
+Giessen, B.C. *(ed.)* 69790
+Giffard, R.P. 73694
+Giginyak, F.F. 73308
Gigli, G.+ 72076
+Gilbart, E. 73021
+Gilbert, C. 70859
+Gilbert, S.L. 70814
+Gildenblat, G. 72258
+Gildenblat, G. 72477
Giles, M.J. 71724
Gilinskii, I.A. 72589
Gillaspy, P.H.+ 71613
+Gilles, J.M. 72240
+Gilles, P.W. 72093
Gillespie, A.R.+ 73940
+Gillespie, R.J. 70889
+Gilli, J.M. 71869
Gillies, D.C. 72129
+Gilligan, W.H. 73339
+Gillis, J.R. 74064
+Gilmore, A.C. 74049
+Gils, H.J. 70615
+Gils, H.J. 70606
Gimanov, V.P.+ 70748
+Gimzewski, J.K. 70948
Gin Kang .... see Kang Gin
Ginsburg, J.L.+ 70778
Ginsparg, P.H.+ 70345
Ginzburg, L.P. 72449
Ginzburg, V.L.+ 72375
+Giokaris, N. 70394
+Giorgadze, N.P. 72704
+Giovanelli, R. 74164
+Giovanelli, R. 74149
+Giovannella, C. 72356
+Gippius, A.A. 70053
+Girard, J. 70753
+Girardet, C. 70800
Girardi, F. 70656
Girii, V.I.+ 72506
Girt, E. 72148
Gistau, G. 70065
+Gittleman, J.I. 72406
+Gittsovich, V.N. 72717
+Giusfredi, G. 70035
Givargizov, E.I.+ 72283
Gizzi, V. 71302
Gladkov, S.O. 72592
+Gladney, L. 70399
+Gladush, G.G. 71821
Gland, J.L.+ 72247
+Glasberg, B.R. 71306
+Glasberg, B.R. 73594
Glaser, P.+ 72279
+Glashow, S.L. 70345
Glasow, R.+ 70594
Glass, I.S. 73996
+Glass, I.S. 73991
Glass, T.E.+ 70093
Glazov, V.M.+ 72399
+Glazunov, P.Ya. 70698
+Glazunov, V.V. 73549
Glazunov, Yu.T. 71337
Gleeson, J.W.+ 72690
Gleiter, R.+ 70946
+Glick, A.J. 72299
+Glicksman, M.E. 72128
Glinchuk, K.D.+ 72421
+Gloeckler, G. 74061
Glogarova, M.+ 71871
+Glowacka, E. 73724
+Gmelin, E. 72071
+Gobbi, A. 70576
+Gobbi, A. 70612
+Gobel, E.O. 71123
Godbole, R.M.+ 70416
+Godbole, R.S. 72978
+Godone, A. 70035
+Godowitch, J.M. 73859
+Goel, T.C. 72293
Goeler, S.von .... see von Goeler, S.
+Goganov, D.A. 70748
+Gohel, V.B. 72073
Golant, V.E. 71756
+Gold, A. 72286
+Gold, M.S. 70399
+Gol'dberg, E.P. 74002
Goldberg, H. 70275
+Goldberg, W. 70455
+Goldberger, J. 70419
Goldenbaum, G.C. 71778
+Goldflam, R. 70354
+Goldhaber, G. 70399
+Goldhar, J. 71146
+Goldhoorn, P.B. 70591
+Goldhoorn, P.B. 70518
+Golding, L.J. 70399
Goldman, A.+ 74064
+Goldman, M. 71833
Goldman, T.+ 70246
+Goldman, T. 70272
+Goldmann, A. 72961
+Goldmann, A. 72957
Goldring, G. 70582
+Goldstein, A. 74094
+Goldstein, J.L. 73587
Golebiowski, J. 71058
+Golikov, Yu.V. 71946
Golovach, I.I. 71334
Golovanov, V.A.+ 71421
+Golovin, Ya.A. 70502
+Golovkov, M.S. 70525
+Golowkow, M. 70455
Golubovskii, E.R.+ 73211
+Golubovskii, E.R. 73305
Golyshev, V.D.+ 70057
Gombosi, T.I.+ 74038
+Gomes, W.P. 72732
+Gomez del Campo, J. 70597
Gomoyunova, M.V.+ 72901
+Gondrand, J.C. 70607
+Gonggrijp, S. 70591
+Gonik, M.A. 70057
Gonis, A.+ 72288
+Gonsior, B. 70577
+Gonthier, P. 70618
+Gonthier, P.L. 70575
Gonzalez, C.C.+ 73452
+Gonzalez, D. 72133
Gonzalez-Arroyo, A.+ 70223
Gonzalez-Calbet, J.M.+ 72254
+Gonzalo, J.A. 72741
+Gooch, T.G. 73251
+Goodman, E.M. 73630
+Goodman, G.L. 70949
+Goodman, L.S. 70803
Goods, S.H. 73276
+Googe, W.D. 73999
+Goossens, R.J. 70414
Gopalan, M.A. 71655
Gopikrishna, N.+ 72074
+Gorbachev, E.A. 72431
Gorbachev, Yu.P.+ 70081
Gorbatyi, N.A.+ 72194
+Gorbatyi, N.A. 72474
Gorbenko, B.Z.+ 71252
+Gorbunov, A.A. 71758
Gorbunova, O.K.+ 73896
Gorczynski, J.+ 71279
+Gordienko, A.I. 73127
+Gordley, L.L. 73885
+Gordon, H.A. 70419
+Gordon, R.G. 71938
+Gore, R. 73848
+Gorelenko, Yu.K. 72633
+Goremychkin, E.A. 72595
Gorenshtein, M.I.+ 70324
Goring, W.P. 73993
Gorishny, S.G.+ 70202
Gorla, R.S.R.+ 71550
Gorlin, G.B.+ 70128
+Gorman, A.D. 71289
+Gorn, W. 70585
+Gorobchenko, V.D. 72719
Gorodetskii, D.A.+ 72214
+Gorodetzky, P. 70753
Gorodzha, L.V.+ 72470
Gorokhov, V.M.+ 73031
Gorokhovatskii, Yu.A.+ 72424
+Gorozhankin, V.M. 70500
+Gorse, C. 70858
+Gorse, C. 71002
+Gorshkov, B.L. 70636
Gorski, M.+ 73926
+Gorynya, L.M. 72763
+Gosele, U. 72151
+Gossard, A.C. 72769
+Gosset, J. 70753
+Gosztola, L. 72278
+Goto, F. 73006
Gotsulyak, E.A.+ 71390
Gotts, H.S.+ 72299
+Gotze, W. 72286
Gouda, V.K.+ 73253
Gough, D.I. 73722
+Gough, D.I. 73779
+Gouin, F. 69887
Gouin, H.+ 69887
Gould, A.J. 73015
+Gould, W.J. 73604
+Gounand, F. 70827
+Gourlay, D.L. 72734
+Goutte, D. 70435
Gove, H.E. 70142
+Govor, L.I. 70483
+Gower, M.C. 70934
+Goyal, A. 70237
+Goyal, A. 70356
Grabert, H.+ 69996
Grabianowski, A.+ 73108
Gradov, O.M.+ 71742
+Gradov, O.M. 71740
+Grafs'kii, I.Yu. 71436
+Grafstrom, P. 70408
Graindorge, Ph.+ 71246
Gralla, S.+ 70576
+Gramegna, F. 70744
+Gramz, M. 71057
Grand, D.+ 72303
Grandi, S.A. 74170
Grandin, A.+ 72391
Grandt, A.F., Jr.+ 71476
Granier, B.+ 72093
+Grannis, P.D. 70419
+Grant, A. 70307
+Grant, C.S. 72258
+Grant, E.H. 73529
+Grant, E.H. 73552

Grant, M.+ 71585
Grant, P.M.+ 73664
Grantsev, V.I.+ 70553
+Grassano, U.M. 72839
+Grassler, H. 70307
Grasyuk, A.Z.+ 71142
Grathwohl, G.+ 73051
+Grathwohl, G. 73039
+Grau, P. 73302
Gravereau, P.+ 71947
+Graves, M. 73864
Graw, G.+ 70443
+Gray, C.G. 71855
+Gray, R.G. 70720
+Grayevsky, A. 72686
+Grechanyuk, M.I. 72257
+Greco, M. 70397
Greegor, R.B.+ 71891
Greeley, H.P. 73673
Greeley, R.+ 74030
+Green, D. 74043
Green, D.J. 73185
Green, D.M.+ 73586
Green, D.W.+ 70866
+Green, D.W.E. 74053
+Green, D.W.E. 74047
+Green, D.W.E. 74051
Green, F. 70216
+Green, F. 70194
+Green, R.F. 74175
Greenberg, A.R.+ 72111
Greenblatt, G.D.+ 73356
+Greenblatt, M. 72393
+Greene, J.E. 72752
+Greenebaum, B. 73630
+Greenebaum, M. 73648
Greensite, J.+ 70321
+Greensite, J. 70172
+Gregoire, C. 70612
+Gregora, I. 72801
Greiner, W.+ 70581
+Greiner, W. 70316
+Greiner, W. 71047
+Greiner, W. 70463
+Grellman, W. 73302
Grenader, A.K.+ 73553
+Grenier, J.C. 72254
+Grenishin, A.S. 71167
Gresillon, D.+ 71800
+Gressier, P. 72379
Gressus, C.Le *see* Le Gressus, C.
Gribbin, J. 73910
Gribnikov, Z.S. 72410
+Gribov, L.A. 70771
+Grider, D. 72242
Griem, H.R. 71688
+Griem, H.R. 71705
+Griep, D. 74050
Gries, W. 70649
Griffin, D.C.+ 70761
Griffiths, R.B.+ 70014
+Grigalashvili, T.S. 70413
Grigorenko, Ya.M.+ 71376
Grigor'yants, A.G.+ 73236
+Grimm, F.A. 70952
Grimson, M.J.+ 73524
Grinberg, M.+ 72337
+Grinberg, Ya.M. 73046
Grinchenko, V.T.+ 71457
+Grindlay, J.E. 74182
+Grindlay, J.E. 74096
Grinfel'd, M.A. 73789
Grinvald, G.A.+ 72853
Grinvald, G.A.+ 72854
Grioli, G. 71358
Grischkowsky, D.+ 72929
+Grisel, A. 72810
Grishchuk, V.P.+ 72814
+Grishin, S.D. 73075
Grodzinsky, A.J. 73624
+Grolier, M.J. 74025
+Gromov, E.P. 70055
+Gromov, K.Ya. 70507
+Gromov, K.Ya. 70500
Gron, O. 69819
+Gropyanov, V.M. 73045
+Gross, D.H.E. 70580
+Gross, D.R. 73684
+Gross, E.E. 70617
Grosse, E.+ 70587
+Grossi, G. 73316
Grossman, J.G.+ 71138
Grover, J.R.+ 70654
+Groves, R.D. 72828
+Groves, S.H. 72411
+Grow, R.W. 71180
+Growcock, F.B. 73167
+Grun, J.-B. 72805
Grundevik, P.+ 70802
Gruner, K.+ 71646
+Grung, B. 70368
+Gruninger, J. 73495
Gruza, G.V.+ 73895
Gruzdev, V.A.+ 72970
Gryntakis, E.M.+ 69798
Grzywna, Z.J.+ 72229
Grzywna, Z.J.+ 72230
Gu Bing-lin *see* Bing-lin Gu
Guan-chang Jin *see* Jin Guan-chang
Guang-Cheng Xiong *see* Xiong Guang-Cheng
Guang-qian He *see* He Guang-qian
Guang-xi Dai *see* Dai Guang-xi
Guanghan Wu *see* Wu Guanghan
Guanglin Kong *see* Kong Guanglin
Guay, F.+ 70859
+Gubanov, V.A. 72603
Gubanova, S.I.+ 73892
+Gubarev, A.P. 72774
Gubarev, S.I.+ 72430
+Gubkin, A.N. 72424
+Gudilina, A.I. 73048
+Gudima, K.K. 70570
Guelachvili, G.+ 70983
Guell, A.+ 73670
+Guemas, L. 72379
+Guerin, R. 71928
Guerra, A.Del *see* Del Guerra, A.
+Guerra, G. 73438
Guerreau, D.+ 70603
+Guerreau, D. 70592
+Guerreau, D. 70595
+Guerreau, D. 70578
+Guest, J.E. 74024
+Guet, C. 70586
+Gugov, I. 71888
Guha, A.+ 70224
Guha, S.+ 70779
Gui-fang Yu *see* Yu Gui-fang
Gui-yu Chen *see* Chen Gui-yu
+Guido, M. 72076
Guidotti, D.+ 71183
Guillaume, C.Benoit a la *see* Benoit a la Guillaume, C.
Guillemin, V.+ 70015
Guillon, D.+ 71873
+Guillory, W.A. 73325
+Guillory, W.A. 70895
Guillou, B.+ 71542
+Guimbal, P. 71030
+Guinet, D. 70635
+Gujrati, P.D. 70014
+Gulacsi, M. 72608
+Gulacsi, Z. 72608
+Gul'ko, N.V. 73048
+Gull, T.R. 74134
+Gulyaev, V.I. 71390
+Gulyaev, Yu.V. 72767
Gumhalter, B.+ 72923
Gumienny, Z.+ 72766
Gun-hung Wu *see* Wu Gun-hung
+Gunichev, A.F. 70101
+Gunn, J.E. 74171
+Gunn, J.E. 74159
+Gunnarsson, O. 72886
+Gunther, H. 70911
+Gunther, H. 70927
+Guo Ben-yu 69896
Guo Chang-lin 71933
+Guo Hu-ling 71988
Guo Zhu-kun+ 72152
Guo-Dong Li *see* Li Guo-Dong
Guo-pu Lei *see* Lei Guo-pu
Gupalo, Yu.P.+ 71638
+Gupta, A.K. 73096
+Gupta, D.C. 71446
Gupta, H.O.+ 72641
+Gupta, M. 70353
Gupta, P.K.+ 73491
+Gupta, R.K. 71746
Gupta, S.K. 73915
+Gupta, S.K. 70387
Gupta, V.+ 70380
Gurevich, G.S.+ 70530
Gurevich, L.E.+ 72419
Gurevich, M.E.+ 72142
Gurin, V.N.+ 72979
+Gurtler, P. 70897
+Gurtov, V.A. 72510
+Gusev, I.V. 72999
+Guseva, T.V. 70487
+Gus'kov, B.N. 70413
+Gustafsson, L. 70408
+Gustavsson, M. 70802
+Gutbrod, H.H. 70517
+Gutekunst, H. 73695
+Guterch, B. 73723
+Guterman, A. 70608
Guther, R. 71092
Gutkowicz-Krusin, D.+ 71512
+Gutkowski, M. 71215
+Gutkowski, M. 71218
+Gutkowski, M. 71219
+Gutlich, P. 73256
+Gutov, V.S. 72220
+Guttman, H.-J. 73256
Guyot, M.+ 72631
+Guz', A.G. 71760
Guz', A.N.+ 71407
Guz', A.N.+ 71417
+Guz, A.N. 69878
Guz', I.S.+ 73306
+Guza, R.T. 73817
+Guzhva, N.S. 73157
+Guzzi, M. 72435
+Gyarmati, E. 72165
+Gyulai, J. 71997

Ha Sung-Chul *see* Sung-Chul Ha
+Haaks, D. 70897
+Haan, S. 71030
+Haas, Y. 70962
+Haase, M.A. 72404
+Habeeb, M.A.Z. 72619
Habel, J. 70100
Habib, F. 70685
+Hackett, P.A. 73354
Hadi Abboud Ja'Afar *see* Ja'Afar Hadi Abboud
+Hadjipanayis, G. 71896
Hadziahmetovic, D.+ 72542
+Haenni, D. 70618
Haenni, D.R.+ 70614
Haenny, L.+ 73121
Haenny, L.+ 73134
Haese, N.N.+ 71698
+Hafner, W. 70886
+Hafskjold, B. 71857
Hafter, E.R.+ 73597
+Hagberg, E. 70408
+Hagberg, E. 70506
+Hagelberg, R. 70418
+Hagelin, J.S. 70369
+Hagelin, J.S. 70378
+Hagemann, G.B. 70442
+Hagenmuller, P. 71942
Hager, B.H. 73706
+Haggag, M.H. 71072
+Haggerty, J.S. 73187
+Haggerty, J.S. 73238
Haggerty, S.E.+ 73934
+Hagio, T. 73056
Hagston, W.E. 72480
+Hahn, A.A. 70496
+Hahn, E.W. 73629
+Hahn, H. 70689
Hahn Bong Hee *see* Bong Hee Hahn
+Haighton, E.J. 71053
Haines, M.G. 71779
Hajdukovic, D.S.+ 72568
Hajnal, M. 73295
+Hakamatsuka, Y. 71904
+Halary, J.L. 71907
+Halbach, R.E. 73650
Halberg, L.I.+ 72996
+Halbwachs, M. 71931
+Hale, A. 74047
+Hall, E.L. 73264
+Hall, J.H., Jr. 70862
Hall, L.+ 69968
+Hall, R.I. 71024
Hall, R.L. 69975
Haller, P.+ 70660
+Hallin, R. 70823
+Halperin, B.I. 72184
+Halpern, M.B. 70172
+Halpern, M.B. 70321
+Halsteinslid, A. 70368
+Hamabata, H. 71721
+Hamada, K. 71121
Hamada, Y.+ 69995
+Hamano, Y. 72654
Hamatsuki, T.+ 73948
Hamber, H.W. 70319
Hamer, R.D.+ 73609
Hamilton, J.H. 70743
+Hamilton, W.D. 70426
+Hamilton, W.D. 70485
Hammerli, M. 70722
+Hammerschlag-Hensberge, G. 74072
+Hammitt, F.G. 73226
+Hammitt, F.G. 73230
+Hammond, R.B. 72443
Hammond, R.T. 70290
+Hamrick, F.C. 73944
+Hamstad, M.A. 73168
Hamstra, J. 70658
+Hamzic, A. 72615
Han, D.+ 70309
+Han, G.C. 73822
+Han Hongyin 70629
Hanabusa, T.+ 71837
+Hanak, J.J. 72438
+Hanawa, T. 72937
+Hangleiter, A. 72322
+Hanley, H.J.M. 71681
Hanna, S.B.+ 73039
+Hanna, S.B. 73051
+Hanrahan, C.P. 73327
+Hanratty, T.J. 71519
+Hanratty, T.J. 71520
+Hansen, D.V. 73822
+Hansen, F.D. 73790
Hansen, J.C.+ 70865
Hansen, J.P.+ 71690
+Hansen, L.K. 72597
Hansen, O.+ 70620
+Hanser, A. 70451
+Hanson, G. 70399
Hanson, H.G. 69985
+Hansroul, M. 70418
Hanss, M. 73690
+Hansson, T.H. 70352
Hantzche, E. 71816
+Hanusovszky, A. 72932
Hao Bai-lin+ 69983
Hao-Lin Chen+ 70807
+Hara, M. 71152
Hara, N.+ 73282
+Hara, T. 73948
+Hara, T. 69885
Harada, A.+ 69911
+Harada, I. 70888
+Harada, K. 71255
+Harada, K. 70613
Harada, M.+ 71852
Harari, H. 70360
+Harbison, J.P. 72859
Hardee, P.E. 73987
+Harding, K. 70664
+Harding, L.B. 70792
Hardy, A.+ 71101
+Hardy, A. 71195
+Hardy, A. 71196
+Hardy, J.C. 70506
+Hardy, W.H. 70165
+Hargrove, C.K. 71041
Hari Dass, N.D.+ 70213
+Hark, S.K. 71945
Harkonen, H.+ 70683
Harmer, A.L. 71251
+Harmon, J. 74052
+Harmony, M.D. 70853
+Harnden, F.R., Jr. 74128
+Harnden, F.R., Jr. 74096
Harrell, E.M.+ 69904
Harris, C.K.+ 72628
Harris, H.C. 74155
+Harris, J.H. 72832
Harris, S. 69984
+Harris, W.E. 74150
+Harris, W.E. 74151
Harris, W.J. 73287
+Harrison, D.E. 70704
+Harrison, D.E., Jr. 72020
+Harrison, I.R. 72799
+Harrowell, P.R. 71853
+Harsh 73449
+Hart, R.L. 73873
+Hart, W.D. 73943
+Hartfiel, J. 70631
+Hartig, H. 70134
+Hartmann, E. 70809
Hartmann, K.M.+ 70580
+Hartmann, L. 74067
+Hartmann, S.R. 71206
Harvey, J.A. 70269
+Harwood, L.H. 70604
+Hasan, F. 72877
Hasegawa, A. 70568
Hasegawa, A.+ 70567
Hasegawa, H.+ 70220
+Hasegawa, H. 69911
Hasegawa, M.+ 73262
+Hasegawa, M. 71781
+Hasert, F.J. 70307
+Hashimoto, C. 72508
Hashimoto, S.+ 71762
Hasiguti, R. 72004
Haskell, A. 73967
Haslinger, J.+ 69863
Hassab, M.A. 71340
+Hassan, S.S. 70808
+Hasselman, D.P.H. 71381
+Hasselman, D.P.H. 71382
+Hasson, A. 71119
Hassoun, Y.+ 70197
Hastings, I.J.+ 70720
+Hattula, J.S. 70441
+Haudin, J.M. 71867
+Hauenstein, R.J. 72865
+Haug, H. 72325
Hauser, W.+ 70673
+Hausser, O. 70431
Havelsky, V. 73469
Havens, J.R.+ 71908
Havlin, S.+ 70001
Havner, K.S.+ 71968
+Havskov, J. 73780
Hawkins, R.L.+ 70957
Hawley, N. 73787
+Hawranek, J.P. 70856
Hayafuji, Y.+ 72005
Hayase, Y.+ 70661
+Hayashi, K. 71323
+Hayashi, M. 70661
+Hayashi, Y. 73997
+Hayes, A.C. 70457
Hayes, D.E. 69796
+Hayes, E.F. 73328
Hayes, J.M.+ 73380
Hayes, W.+ 72155
Hayess, E. 71801
+Haynes, M.P. 74164
+Haynes, M.P. 74149
Haynes, W.M. 72025
+Hayward, G.A. 70728
Hayward, P.J.+ 70700
He Fu-bao 71362
He Guang-qian+ 71361
He Xian-tu 71736
He Xiangtao+ 74179
+Head, J.D. 70780
+Head, J.W. 74007
+Head, J.W. 74012
+Head, J.W., III 74022
+Healey, D. 70539
Heard, H.C.+ 73791
+Hearnshaw, J.B. 74075
Heather, R.W.+ 70970
+Heavens, O.S. 72879
Hebard, A.F.+ 72548
Hebel, W.+ 70670
Heble, M.P. 70021
Hecht, A.M.+ 73373
+Heckel, K. 73130
+Hecker, S.S. 71467
+Hecker, S.S. 73169
Heckman, T.M. 74142
+Hede, A.J. 73499
Hee Chung Ok *see* Ok Hee Chung
Hee Hahn Bong *see* Bong Hee Hahn
+Hee Kyong Moon 73109
Hefang Hu+ 71895
+Hefetz, M. 73370
+Hegab, M.K. 70560
+Hegarty, A.F. 73317
+Hegedus, Z. 72893
Heggie, D.C. 73970
+Heidenreich, W. 69960
Heigl, H.+ 73130
Heijst, G.J.F.van *see* van Heijst, G.J.F.
+Heil, F. 70682
+Heil, T.G. 71008
+Heimerl, J.M. 73338
Heinich, H. 70003
Heintzmann, H.+ 71789
+Heinz, K. 72205
Heiti, R.V.+ 73418
+Helbig, V. 70817
+Helfrich, U. 72168
+Heller, B. 71056
+Heller, M. 74187
Hellmann, J.R.+ 73071
Hellmann, J.R.+ 73072
Helm, H.+ 70972
Helmreich, D.+ 73093
+Hemmer, P.C. 72571
+Hemon, A. 71800
Henbest, N. 73968
+Henderson, J.R. 72183
+Henderson, P.J. 73144
+Hendrie, D.L. 70608
+Henley, E.M. 70354
+Henneberg, P. 73637
Henneberger, W.C.+ 69835
+Hennig, J. 70861
Henning, M.L.+ 71245
+Henning, W. 70638
+Hennings, D. 73923
Henocque, J.+ 72794
Henrichs, H.F.+ 74072
+Henriksen, R.N. 74167
+Henry, R.J.W. 71019
+Henry, R.J.W. 71016
+Hensley, W.K. 70497
+Henson, G. 74110
+Hentschel, E. 70455
Hepp, K.+ 71104
+Herdtweck, E. 71934
+Hering, W. 70623
Herion, J.+ 72189
+Heritage, J.P. 71182
+Hermanson, J. 72951
Hermansson, H.-P.+ 70701
+Hernando, A. 72597
+Herold, U. 72131
Herrero Fernandez, M.P.+ 73388
+Herrick, R.S. 71962
Herrin, E. 73928
+Herrington, C.R. 72452
+Herrmann, F. 70455
+Herrmann, G. 71472
+Herrmann, L.R. 71372
Herrmann, R.B. 73931
+Herskind, B. 70442
+Hertz, J. 71892
+Herziger, G. 71807
Hess, B.A., Jr.+ 70836
+Hess, D.M. 73629

+Hessberger, F.P. 70641
+Hesse, W. 70694
Hession, P.J.+ 73415
+Heuter, J. 73394
Hewig, G.H.+ 73462
Hewitt, J.N.+ 74149
Heyes, D.M.+ 71508
Heymann, D. 74091
Heyne, K.G.+ 73468
+Hibou, F. 70584
Hickling, R.+ 71264
+Hickmott, T.W. 72482
Hidaka, T. 71240
+Hieu Phan, T. 71872
Higashijima, K. 70346
+Hihara, T. 72684
+Hiki, Y. 72069
+Hildenbrand, K.D. 70576
Hildred, G.P.+ 70808
+Hill, G.M. 73452
+Hill, R.I. 71939
+Hillaire-Marcel, C. 73797
+Hillebrecht, F.U. 72886
+Hiller, K. 74024
Hiller, K.H. 74023
+Hiller, K.-H. 70413
Hillert, M. 72112
Hills, D.A. 71495
+Hilscher, D. 70609
Hiltunen, E.+ 71879
+Himpsel, F.J. 72955
+Hincks, E.P. 71041
+Hind, D. 73021
Hindam, H.+ 72166
+Hine, A. 74052
Hines, E.L.+ 73904
Hines, J.G. 73248
+Hines, J.G. 73247
+Hingmann, R. 70641
+Hino, T. 72445
Hintz, E. 71799
Hintz, H.+ 71316
Hinz, G.+ 73643
+Hipel, K.W. 73398
Hippel, F.von *see* von Hippel, F.
+Hippelein, H. 74156
+Hirabaru, O. 72937
Hirata, K. 69902
+Hirlimann, C. 72804
+Hirlimann, C.A. 71148
+Hiro, Y. 72157
+Hirooka, S. 70344
+Hiroshima, H. 70145
+Hirota, E. 70851
+Hirsch, J.E. 70002
Hirsekorn, S. 72053
Hirsh, R.S.+ 69893
+Hirst, A.M. 73666
+Hishiyama, Y. 73056
+Hites, R.A. 73492
+Hladky, J. 70413
Hlavac, S.+ 70482
+Ho, H. 70575
+Ho, H. 70594
+Ho, T.C. 71629
Ho, Y.K.+ 71016
Ho Tak San *see* Tak San Ho
+Ho Tso-hsiu 70503
+Ho Yu-ping 73312
+Hobner, H.-P. 73462
+Hoch, M. 72137
+Hochheimer, H.D. 72606
Hodge, P.W.+ 74000
Hodgkinson, D.P.+ 70651
Hodgson, D.+ 70721
Hodul, D.T. 72811
Hoefs, J. 73916
Hoeijmakers, H.W.M.+ 71561
+Hoeppner, D.W. 71477
+Hoessel, J.G. 74159
+Hofer, W. 72931
Hoff, D.+ 70084
Hoffbauer, M.A.+ 70971
+Hoffer, T.E. 71613
Hoffman, G.L.+ 74186
+Hoffman, H.J. 71198
+Hoffman, R.C. 71172
+Hoffman, R.W. 73244
Hoflund, G.B.+ 72255
+Hofmeister, W. 71941
Hogaasen, H.+ 70347
Hogarth, C.A.+ 72390
+Hogervorst, W. 70797
+Hogg, C.S. 72224
+Hogstrom, U. 73862
Holdahl, S.R. 73776
+Holden, J.E. 73662
Holland, R.F.+ 70872
+Holland, R.F. 70894
+Holland, W.R. 73814
Hollas, J.M.+ 70975
+Hollebeek, R.J. 70399
+Holloway, P.H. 72255
Holman, G.D.+ 74060
Holmes, H.F.+ 73359
+Holmes, J.K. 71013
+Holmgren, H.D. 70608
+Holmstrom, V.J.M. 73432
Holnicki-Szulc, J. 71377
Holoubek, J. 70106
+Holt, W.H. 73177
+Holzwarth, N.A.W. 70768
Homewood, K.P.+ 72698
Homma, H.+ 73179
Hon, R.A.De *see* De Hon, R.A.
Honda, K. 72613
+Honda, K. 72780
Hondros, E.D.+ 73144
+Honess, D.J. 73552
Honeycomb, J.+ 73251
Honeycombe, R.W.K. 73092
+Hong, S.H. 71962
Hong Shon Nguyen *see* Nguyen Hong Shon
Hong Zhou Sun *see* Sun Hong Zhou
Hong-jun Zhang *see* Zhang Hong-jun
Hong-yuan Shen *see* Shen Hong-yuan
Hongyin Han *see* Han Hongyin
Honinger, H.+ 73153
Hooft, G.W.'t *see* 't Hooft, G.W.
+Hooke, W. 71729
Hooper, A.P.+ 71517
+Hopkins, R.H. 73454
+Hoppenbrouwers, P. 70414
+Hopper, G.F. 72155
+Hopster, H. 72948
+Horanyi, M. 74038
Horbatsch, M.+ 71012
+Horen, D.J. 70617
Horgan, C.O.+ 69881
+Horgan, R.R. 69862
+Horii, S.C. 73659
+Horikoshi, H. 71982
+Horinouchi, A. 71257
Horiuchi, H. 69928
+Horkay, G. 70071
+Horl, E.M. 72922
Hormes, J.+ 70898
Horn, D.+ 70431
Horn, H.M.Van *see* Van Horn, H.M.
+Horn, K. 72234
+Hornaes, A. 70368
Hornbogen, E.+ 71905
+Horneff, H. 72168
+Hornsby, P.R. 71906
Horodecki, R. 69918
+Horowitz, M. 70887
Horsdal-Pedersen, E.+ 71007
Horseman, P.R.+ 73651
+Hosea, J. 71729
Hoselitz, K. 72635
+Hoshino, S. 72544
Hoshino, Y.+ 70083
+Hosking, R.J. 71669
Hosono, H.+ 72664
+Hoste, J. 70741
Houssine el Ghadraoui El *see* El Houssine el Ghadraoui
Hove, M.A.Van *see* Van Hove, M.A.
Hoven, G.Van *see* Van Hoven, G.
+Hovestadt, D. 74061
Hovey, P.W.+ 73171
+Howarth, I.D. 74072
Howe, D.A.+ 70039
Howie, A. 71843
+Howland, H.C. 73561
Hoyng, P.+ 74058
Hoyt, D.V.+ 73912
+Hristov, H. 72586
Hryniewicz, Z. 71434
Hsi-Ho Liu+ 73744
Hsiao-wei Tang *see* Tang Hsiao-wei
Hsichun M. Hua 71369
Hsieh, C.K. 73475
Hsieh, C.K.+ 73474
Hsieh, K.-C.+ 73070
+Hu, P. 72859
Hu Hefang *see* Hefang Hu
Hu Ning 70176
+Hu Ning-hai 71952
+Hu Zhi-xiong 72359
Hu-ling Guo *see* Guo Hu-ling
Hua Hsichun M. *see* Hsichun M. Hua
Hua-mo Wu *see* Wu Hua-mo
+Huang, C.C. 72108
Huang Jing-Ning *see* Jing-Ning Huang
+Huang Shangjun 71028
+Huang Shangjun 71031
+Huang Shengnian 70629
Huang Wi-tze 73506
+Huang Xiao-liang 71129
Huang Yen 71363
+Huang Yi-sen 71914
Huang Yong-kai 70126
Huang Yong-nian 73962
Huang Yu-shan+ 71460
Huang Yu-ying+ 71412
Huang Zhong-Xian *see* Zhong-Xian Huang
Hubeny, I.+ 70818
Hubeny, I.+ 70819
Huber, B. 70666
+Huber, D. 73093
+Huber, M.G. 70642
+Huberman, B.A. 70002
+Hubsch, J. 72609
+Huchra, J.P. 74173
+Hudry-Clergeon, G. 73523
+Huebener, R.P. 72550
Huerta-Quintanilla, R.+ 70381
+Huff, R.W. 71743
+Huggins, P.J. 74129
+Hughes, R.J. 70298
Hughes, T.P.+ 71761
Hughston, L.P.+ 70208
Hugon, P.Leroux *see* Leroux Hugon, P.
Huguet, P.+ 72658
Huh, O.K. 73826
Hui-guo Deng *see* Deng Hui-guo
Hui-lin Ni *see* Ni Hui-lin
+Huie, A. 70585
Huiku, M.T.+ 72605
+Huizenga, J.R. 70609
+Huleihil, Kh. 70187
+Hulet, R.G. 70796
+Hulliger, F. 71940
Hulme, A. 71582
Hulst, J.M.van der *see* van der Hulst, J.M.
+Hulstrom, R.L. 73422
+Hulth, P.O. 70307
+Humanic, T.J. 70638
Humbert, P.+ 72126
Humbert, P.+ 72193
+Humbert, P. 73243
+Humeau, P. 71662
Hummel, E.+ 74093
Hummel, R.E. 70108
Humpert, B.+ 70334
Hunckler, C.J.+ 71429
+Huneke, J.C. 73940
+Huneke, J.C. 74057
Hunklinger, S. 72070
+Hunklinger, S. 72057
+Hunklinger, S. 72060
+Hunklinger, S. 72046
+Hunklinger, S. 72821
+Hunklinger, S. 72545
+Hunt, C.E.L. 70720
+Hunter, D.A. 74146
Hunter, R.L.+ 70138
+Hunter, T.F. 70840
+Hunter-Duvar, I.M. 73602
+Huntington, H.B. 72167
+Hupke, R. 70642
Hur-bin Sun *see* Sun Hur-bin
+Hurd, A.J. 71864
+Hurd, T.R. 70208
+Hurlimann, W. 72917
Hurst, J.M.+ 73796
+Hurwitz, C.E. 72411
+Huse, D.A. 72087
+Husebye, E.S. 73733
+Hussain, Z. 72964
Hussein, E.+ 70714
+Hussein, M.S. 70640
+Hussey, E.M. 73755
+Husson, E. 72792
Hutcheson, L.D. 71256
Hutchins, C.M. 69849
+Hutchins, G.A. 73266
Hutchinson, R.W. 73769
+Hutchison, J.L. 72019
+Hutchison, J.L. 71939
+Hutchison, J.L. 71954
+Huttner, W. 70959
+Hutton, D.R. 72666
+Huyser, E.S. 70791
+Huzita, H. 70368
Hvistendahl, J.+ 72143
Hwang, B.+ 72443
+Hwang, H.N. 73644
Hwang, N.H.C.+ 73684
Hwang, W.+ 72416
Hwang Keh-chih+ 71411
+Hwang Keh-Chih 71397
Hyde, M.L.+ 73676
+Hyder, S.A. 72439
+Iaci, G. 70096
+Ibe, H. 71078
+Ibrahim, N. 70857
Ibuka, M.+ 70080
Icaza-Herrera, M.de *see* de Icaza-Herrera, M.
Ichimura, M.+ 73101
Ichimura, M.+ 73102
+Ichinose, S. 70222
+Ideguchi, T. 73142
+Ideura, K. 70016
Idrissi, A.Il *see* Il Idrissi, A.
Idrus, N. 72195
Iglesias, C.A. 71691
Ignaczak, J. 71384
Ignatov, S.F.+ 71622
Iizuka, T. 71916
Iizuka, T.+ 72840
+Ijdo, D.J.W. 71944
Ikebe, M.+ 72558
+Ikeda, K. 72651
+Ikeda, K. 71678
+Ikegami, S. 73437
Ikoma, T.+ 72267
+Il Idrissi, A. 71662
Iles, P.A. 73445
+Il'ichev, V.Ya. 73161
+Iljin, A.I. 70636
+Ille, B. 70408
+Iller, A. 72348
+Im, H.B. 73110
+Imabayashi, M. 73101
+Imabayashi, M. 73102
Imamura, Y.+ 71403
Imbert, M. 73567
+Imme, G. 70436
+Inada, R. 72559
Inculet, I.I.+ 71835
+Inculet, I.I. 71832
Innanen, K.A.+ 74151
+Innes, G.S. 73657
+Innes, W.R. 70399
+Inokuchi, H. 72945
Inomata, A. 72567
Inomata, T. 73645
Inomata, T.+ 73340
Inoue, M.+ 72788
+Inoue, N. 72840
+Inoue, S. 73192
+Inoue, S. 72329
+Inoue, T. 71831
+Inoue, Y. 73195
Inouye, T.+ 73557
Ioakimidis, N.I. 71463
+Iomin, A.M. 69921
+Iori, I. 70744
Ioselevich, A.S. 72743
+Ippen, E.P. 71150
+Ippolitov, V.T. 70523
Iqbal, A.+ 73238
+Iqbal, M. 73416
Irene, E.A.+ 72975
Iribarne, J.V.+ 73384
Irons, G.A.+ 71672
Irretier, H. 71449
+Irshad, M. 70543
+Irzhak, V.I. 72139
+Isaacs, E.D. 71182
Isabelle, D.B.+ 73652
Isacker, P.van *see* van Isacker, P.
+Isakov, V.G. 72971
+Ise, Y. 73480
+Isebaert, A. 70741
Isgur, N.+ 70311
Ishankuliev, D.+ 70531
+Ishchenko, A.A. 70958
+Ishibashi, Y. 72789
+Ishida, H. 71034
Ishida, K.+ 74046
+Ishida, K. 71403
+Ishida, K. 74051
+Ishida, Y. 71255
Ishiguro, T. 70122
+Ishihara, M. 70593
+Ishihara, M. 73194
+Ishihara, M. 73195
Ishii, Y.+ 72653
Ishikawa, K.+ 72392
Ishikawa, T. 71342
+Ishikawa, Y. 72582
Ishil, K.+ 73381
+Ishmaev, S.N. 71903
+Isihara, A. 72463
+Iskander, S.K. 70647
Islam, M.A.+ 70491
Ismail, A.Razzaq *see* Razzaq Ismail, A.
+Ismatov, E.I. 70406
Istomin, Ya.N.+ 73958
+Istomina, Z.A. 71932
+Ito, A.S. 73963
+Ito, N. 73997
+Ito, T. 70652
+Ito, Y. 73368
+Ito, Y. 71617
+Itoga, T. 72426
+Itoh, H. 72446
+Itoh, K. 71121
Itzikowitz, S.+ 71290
Iudice, N.Lo *see* Lo Iudice, N.
+Ivanchenko, I.M. 70413
+Ivanchenko, L.A. 72760
+Ivanchenko, O.N. 73133
Ivanchenko, Yu.M.+ 72564
Ivanov, G.V.+ 70091
Ivanov, M.A. 72361
+Ivanov, M.I. 69857
Ivanov, M.Ya.+ 71623
Ivanov, S.I.+ 70746
+Ivanov, V.G. 72217
+Ivanov, Yu.A. 71453
Ivanov, Yu.M. 73132
Ivanov-Omskii, V.I.+ 72269
+Ivanov-Omskii, V.I. 72420
+Ivanova, I.N. 73255
+Ivanova, S.P. 70484
Ivanova, V.S. 72041
Ivanova, V.S. 72043
Ivanova, V.S. 73212
+Ivchenko, E.L. 72451
+Ivchenko, V.O. 73806
+Ives, L.K. 73232
+Iwa, T. 73686
+Iwabuchi, T. 73002
Iwai, E. 73564
Iwai, Y.+ 73226
+Iwaki, T. 73487
Iwama, Y.+ 72270
+Iwamoto, A. 70613
Iwamoto, N.+ 72665
Iwao, S. 70181
Iwao, S. 70370
+Iwasaki, Y. 70591
+Iwase, H. 73191
Iwata, Y.+ 71447
Iye, Y.+ 72560
+Iyer, R.H. 70632
Iyer, S.Venkatakrishna *see* Venkatakrishna Iyer, S.
+Izuhara, S. 70665
Izutsu, M.+ 71227

Ja'Afar Hadi Abboud+ 73098
Jacak, B.V.+ 70604
Jackins, P.D.+ 71271
+Jackson, D.A. 71249
+Jackson, J.T. 70909
Jacmart, J.C.+ 70598
Jacobi, W. 70726
+Jacobs, S.F. 70109
Jacobsen, E.A.+ 71874
+Jacobson, D.C. 72081
+Jacobson, M.A. 72836
+Jacobson, M.J. 71290
+Jacon, M. 70882
Jadczyk, A. 69952
+Jadhav, A.V. 70632
+Jae-Bong Ann 73551
+Jaegle, P. 71704
+Jaeschke, W. *(ed.)* 69791
Jager, J.+ 73905
Jagodzinski, J.N.+ 72115
+Jahn, P. 70562
Jain, H.+ 72161
+Jain, N.C. 71446
Jain, P.L.+ 70590
Jain, R.K.+ 71202
Jain, S.C.+ 73444
+Jain, S.C. 73449
Jain, Y.S. 69840
+Jain, Y.S. 72779
+Jakab, P. 72761
Jakobsson, B.+ 70611
+Jakobsson, B. 70586
Jakubassa-Amundsen, D.H. 71004
Jakubowicz, A. 72412
+Jalsovszky, G. 70870
+James, J.R. 73654
+James, K.A. 71242
Jaminon, M. 70472
Jani, A.R.+ 72073
+Jankech, A. 70485
+Jankowiak, R. 72776
+Janovec, V. 71871
+Jansen, J.F.W. 70518
Janson, M. 73011
+Janssens, R.V.F. 70591
+Janszen, H. 70631
Jardine, L.J.+ 70702
+Jardine, L.J. 70703
+Jardine, L.J. 70687
Jaric, M.V.+ 73334
+Jaric, M.V. 73522
+Jaros, J.A. 70399
+Jarosewich, M. 74020
+Jarvis, P.D. 70178
+Jastrabik, I 72753
+Jayaraman, A. 72606

Jayaraman, T.+ 70296
Jayaraman, T.+ 70297
Jayaraman, T.+ 70422
Jean, B.R.+ 73939
Jean Paulin, J.Saint .... *see* Saint Jean Paulin, J.
+Jechart, I. 71743
+Jecmen, J 70653
+Jedju, T.M. 72859
+Jedlinski, K. 71215
Jeelani, S.+ 73163
+Jehanno, C. 73784
Jennings, B.K.+ 70627
+Jennings, P.J. 71840
+Jennings, R.E. 74125
Jensen, A. 69939
+Jensen, L.S. 73715
Jensen, P.+ 73522
Jensen, T.E.+ 73492
+Jeremie, H. 70543
Jewitt, D.C.+ 74123
+Ji Ming Rong 70951
Ji-chun Tan ..*see* Tan Ji-chun
Ji-zhong Wang .... *see* Wang Ji-zhong
Jia Wei-yi+ 72310
Jia-ning Xiao .... *see* Xiao Jia-ning
Jia-Zhu Wang 74190
+Jiang Cheng-Lie 70620
Jiang Ding E .... *see* Ding E Jiang
+Jiang Fusong 72746
Jiang Yasi+ 72746
Jiangchen Meng .... *see* Meng Jiangchen
Jilek, M. 71487
Jin Fu-sheng 69882
Jin Guan-chang+ 71497
+Jin Meng-Shi 71412
Jin Moon Tak .... *see* Tak Jin Moon
Jin Wu 73828
Jin Wu 73881
Jin Wu .... *see* Wu Jin
Jin-zhang Chen .... *see* Chen Jin-zhang
Jing-Ning Huang+ 70372
Jingshang, Z.+ 70512
+Jinno, H. 73114
Jirous, F. 71653
Jobes, F.+ 71729
+Johannsen, D.C. 70355
+Johansson, T. 70631
John, P.I. 71752
Johns, B.+ 73804
+Johns, W.E. 73816
+Johnson, A.D. 70399
+Johnson, C.E. 70036
Johnson, D.J.+ 70737
Johnson, J.R.+ 70731
+Johnson, J.R. 74034
+Johnson, J.S., Jr. 73372
Johnson, K.H.+ 72540
+Johnson, K.H. 72091
+Johnson, K.H. 72296
Johnson, M.A. 73399
+Johnson, N.R. 70441
Johnson, P.M.+ 70973
+Johnson, R.C. 70556
Johnson, R.E. 69801
Johnson, R.H.+ 73654
Johnson, T.+ 70989
Johnson, W.R.+ 70830
Johnston, P.D. 70686
+Johnston, P.D. 70678
+Jonathan, N. 70945
+Jones, A.F. 71580
Jones, F.R.+ 72140
Jones, F.R.+ 72141
Jones, H. 73077
+Jones, J.D.C. 71249
Jones, L.M.+ 70349
Jones, R.E.+ 71247
+Jones, R.M. 73372
Jones, R.O.+ 71840
Jones, S.K.+ 70392
+Jones, T.L. 72145
+Jones, T.W. 74168
Jones-Oliveira, J.B. 73671
+Jongejans, B. 70368
Jonker, B.T.+ 72903
Jonker, G.H. 72727
+Jonsson, G. 70611
Jorasz, U. 73581
+Jordan, B. 70897
+Jordan, T.R. 73949
Jorgensen, W.L.+ 70982
Josenhans, H.W. 73842
Joseph, D.D.+ 71620
Joseph, K.Babu .... *see* Babu Joseph, K.
+Joseph, R.R. 70589
+Joshi, D.C. 70238
+Joshi, D.C. 70239
+Joshi, Y.N. 70804
+Joubert, J.C. 73388
+Joullie, A. 72348
Jow, T.R.+ 72153
+Joyeux, D. 71079
+Joyner, W.B. 73728
Ju-fang Chen .... *see* Chen Ju-fang
+Ju-Ik Lee 72514
Juden, H.+ 73683
+Judge, D.L. 70953
Jue Sun .... *see* Sun Jue
+Julesz, B. 73578
+Julien, J. 70753
+Julin, R. 70488
Jun-guo Ren .... *see* Ren Jun-guo
Junxiang Li ..*see* Li Junxiang
Jura, M. 74074
+Jurado, J.R. 72156
+Juret, C. 72202
Jusserand, B.+ 72806
+Justus, C.G. 73888
+Jyrkkio, T.A. 72605

+Kaambre, H.F. 72972
Kaastra, J.S. 73989
+Kabakova, I.I. 72177
+Kaburagi, Y. 73056
+Kachhwaha, R. 73377
+Kachinskii, V.N. 70047
+Kachko, N.A. 73220
+Kachru, R. 70827
+Kachur, O.V. 72257
Kadanoff, L.P. 70025
+Kadar, I. 70833
+Kadar, I. 72963
+Kader, H. 70443
+Kadet, V.V. 73800
+Kadiyala, R.K. 72082
Kadko, D. 73783
+Kadono, M. 72276
+Kadyk, J.A. 70399
+Kadyshnikov, V.M. 73896
+Kaetsu, I. 73137
+Kafka, J.D. 71136
+Kagan, B.V. 70163
Kagan, Yu.+ 72150
Kagan, Yu.+ 72180
+Kaganovich, A.B. 73404
Kaganovich, E.B.+ 72441
+Kagawa, Y. 73947
+Kagawa, Y. 73956
+Kagaya, H.-M. 72084
Kagiyama, S.+ 70344
+Kahan, E. 71774
+Kahn, A. 72203
Kahn, W.K.+ 71231
+Kaibyshev, O.A. 71972
+Kaigorodtsev, A.E. 73894
+Kaindl, G. 72644
Kaiser, H. 71066
+Kaitchuck, R.H. 74115
+Kaito, C. 72274
Kajiki, Y.+ 71080
+Kakar, R.K. 73919
Kakinuma, H.+ 73002
+Kakurin, I.N. 70413
+Kakusho, O. 73607
Kakuta, S.+ 73124
Kalashnikov, S.D.+ 70747
Kalashnikov, V.N.+ 71528
+Kalasinsky, V.F. 70885
+Kalbach, R.M. 70409
Kaldis, E. *(ed.)* 69797
+Kalendarev, R.I. 72284
Kalevich, V.K.+ 72706
Kalevich, V.K.+ 72708
+Kalevich, V.K. 72707
+Kalia, R.K. 72086
+Kalia, R.K. 72083
Kalia, R.K. *(ed.)* 69788
+Kalinichenko, L.P. 73528
+Kalinichenko, V.A. 71528
Kalinin, V.V.+ 72002
+Kalinnikov, V.G. 70507
+Kalinowski, J. 72776
Kalinowski, M.W. 69954
+Kalita, G.E. 72177
+Kallen, F. 73561
Kallne, E.+ 71706
+Kallne, J. 71706
Kalman, C.S.+ 70350
Kal'nin, A.A. 73688
Kalnin, Yu.Kh.+ 71959
Kalra, S.B.+ 72555
+Kalvius, G.M. 72719
+Kalyniak, P. 70384
Kam Liu Wing .... *see* Wing Kam Liu
Kamada, O.+ 72773
Kamal, M.R.+ 73206
+Kamanin, V.V. 70484
+Kamath, G.S. 73442
Kambas, K. 72803
Kamel, A.+ 73808
+Kamigaito, O. 73166
+Kamimura, H. 72537
+Kaminishi, K. 73002
Kaminow, I.P.+ 71135
+Kamlet, M.J. 73339
Kampas, F.J. 73000
Kan Xie .... *see* Xie Kan
Kanaka Raju, K.+ 71445
+Kanani, N. 72080
Kanasewich, E.R.+ 73780
+Kanayama, T. 70145
+Kanazawa, H. 72660
+Kanazawa, T. 72664
+Kandpal, T.C. 71214
Kane, G.L.+ 70424
+Kane, J.R. 71041
Kaneko, F.+ 72446
Kaneko, K. 69994
+Kaneko, N. 72809
+Kaneko, T. 72601
+Kaneko, Y. 73472
Kang, K.S.+ 72988
+Kang, S.-J.L. 73139
+Kang, W.M. 72953
+Kang, W.M. 72966
+Kang Gin 73361
+Kannan, N. 70068
+Kanno, M. 72095
+Kano, G. 71121
Kanomata, T.+ 72601
Kansara, M.+ 73407
+Kantele, J. 70488
+Kantor, Y. 72368
Kanwar Raj+ 70669
+Kapitanov, E.V. 72535
Kapitulnik, A.+ 70007
Kaplan, B. 69829
Kaplan, J.I.+ 70907
Kaplan, M.+ 70595
+Kapoor, R.K. 73854
+Kapralova, N.A. 73382
+Kapranidis, S. 73998
Kapusta, J. 69830
+Karakashian, A.S. 72880
Karaolides, C.K.+ 71444
Karapetian, S.S.+ 72044
+Karatoteva, T.I. 70746
+Karaulov, A.G. 72177
+Karban, O. 70563
+Karbovskii, A.V. 72334
+Kargol, J.A. 73265
Karino, T.+ 73612
Karlhede, A.+ 69956
+Karlikov, D.N. 72763
+Karlsson, L. 70951
+Karnachev, A.S. 72688
+Karnatak, R.C. 72886
+Karpachev, S.N. 72051
+Karpenko, N.N. 70413
Karpus, V.+ 72418
Karr, T.J. 71102
+Karyotakis, Y. 70418
+Kasahara, S. 72665
+Kasai, N. 73006
+Kasha, M. 71117
+Kashchuk, A.P. 70408
Kashem, M.A.+ 72731
+Kashima, N. 71239
Kashyap, R.+ 71248
Kask, N.E.+ 71159
Kasprzak, J.+ 72696
Kassem, M.E.M.+ 72029
+Kassoy, D.R. 73336
+Katagiri, A. 73431
Katayama, I.+ 72917
+Katayama, S. 71830
Katgerman, L. 73076
Kathuria, Y.P. 71061
+Katka, M. 70684
Katnani, A.D.+ 73371
Kato, I.+ 71258
Kato, K.+ 70444
Kato, K.G.+ 71748
+Kato, Y. 70652
+Katori, K. 70593
Katrus, O.A. 73018
+Kats, O.V. 70019
+Katsman, V.I. 72759
+Katsnelson, A.A. 72892
+Katsnelson, M.I. 72603
+Katsouleas, T. 71743
Katsuyama, Y.+ 71255
+Kattamis, T.Z. 73094
Katuya, M. 70366
Katz, D.+ 73140
+Katz, J.L. 73625
+Katz, W. 72258
+Katz, W. 72259
Kauffman, R.L. 70160
+Kauffman, R.L. 70159
+Kaufhold, A. 72910
+Kaufman, H. 70136
+Kaufman, L. 73580
Kaufman, M.J.+ 73025
+Kaufman, S. 73768
+Kaufman, S.B. 70517
Kaufman, V.+ 70815
Kaul, S.N. 72376
+Kaus, P. 70355
Kaushal, R.S. 70325
Kaushal, R.S.+ 69936
+Kawabuchi, M. 71329
+Kawaguchi, T. 72770
Kawahara, W.A.+ 71501
+Kawahito, M. 73368
Kawai, E-i. 70333
Kawai, M.+ 70534
+Kawakami, M. 72684
+Kawakami, S. 73997
+Kawakatsu, H. 72646
+Kawakita, K. 73303
+Kawamo, Y. 71328
Kawanaka, A.+ 73649
+Kawanishi, Y. 73383
Kawano, K.+ 72669
+Kawasoe, T. 73948
+Kawazoe, H. 72664
Kay-Kong Wan+ 69920
+Kayashima, M. 73126
Kaye, C.J. 70667
+Kayushin, L.P. 73543
Kazakevich, M.I.+ 71436
+Kazanskaya, N.F. 70135
+Kazanskii, A.G. 72882
+Kazimierczyk, M. 73724
Ke-cong Ai ....*see* Ai Ke-cong
Keafer, L.S., Jr.+ 73945
+Keane, D. 70585
Kear, B.H. *(ed.)* 69790
+Kebin, E.I. 70532
+Kecskemety, K. 74038
+Keddam, M. 73268
+Keddam, M. 73269
+Keddar, N. 70945
+Keddy, R. 70457
+Kedzia, B.B. 70844
Keegan, J.D.+ 70930
Keel, W.C. 74143
+Keen, N.J. 70654
+Keene, W.C. 73868
Keer, L.M.+ 71357
Keh-Chih Hwang .... *see* Hwang Keh-Chih
Keilhacker, M.+ 71749
+Keitz, E.L. 73496
Kekalo, I.B.+ 72630
+Kekelidze, V.D. 70413
+Kelarev, V.V. 71929
+Keller, A. 71868
Keller, E.+ 73698
Keller, J.G.+ 70641
Keller, P.R.+ 70952
+Kellershohn, C. 73638
+Kellershohn, C. 73697
Kelley, J.+ 70099
Kelley, R.L.+ 74104
+Kellogg, W.W. 73905
Kelly, D.P.+ 70908
+Kelly, R.A. 70765
Kelso, S.M.+ 72831
Kemerink, G.J.+ 72720
Kemerink, G.J.+ 72721
Kemper, F.+ 71014
+Kempf, K. 72325
+Kempner, W.C. 73746
Kemter, F.+ 70645
+Kenawy, M.A. 73106
+Kendall, H.W. 70394
+Kendrick, R. 70092
Kenkre, V.M.+ 72847
+Kennett, T.J. 70491
Kennicutt, R.C., Jr. 74153
+Kennicutt, R.C., Jr. 74000
Kent, M.+ 72733
+Kenyon, S.J. 74146
Keondjan, V.P. 73770
+Kephart, T.W. 70192
+Kephart, T.W. 70193
+Ker, E.L. 72052
Keresztes, S. 73409
+Keresztury, G. 70870
+Kerimov, B.K. 70531
+Kern, T. 73561
+Kerns, R.C. 71824
Kersey, A.D.+ 71249
Kertesz, A.E.+ 73575
Kertesz, L.+ 72892
+Kertesz, L. 72890
+Kertesz, L. 72893
+Kertesz, L. 72891
+Kertkoev, Z.F. 70547
Kesavamoorthy, R.+ 72819
Ketslakh, G.A. 71338
Kettle, S.F.A.+ 72596
Keung, W.-Y.+ 70276
+Keung, W.-Y. 70351
Kevorkov, M.N.+ 72401
+Key, T. 73426
+Keyes, T. 71606
+Keyes, T. 69894
Khadkikar, S.B.+ 70387
+Khaimin, V.A. 70532
+Khain, A.P. 73898
+Khairullina, A.Ya. 71073
Khakoo, M.A.+ 71023
Khalid, S.M.+ 71011
Khan, A.U.+ 71117
Khan, M.M.Taqui ..*see* Taqui Khan, M.M.
Khan, Y.+ 71883
Khan, Z.A.+ 70805
Khandkar, A.+ 73358
+Khandoker, S.I. 71294
Khanna, S.N.+ 71927
Khannanov, Sh.Kh. 71485
Khanra, B.C.+ 72223
Kharboush, M.+ 72775
+Kharitonov, V.V. 72262
+Khar'kovskii, S.N. 72338
Kharlamov, Yu.A. 73278
Khartiev, S.M.+ 71577
+Kharyukova, V.P. 74009
+Khasanov, A.Kh. 72817
Khatri, S.S.+ 72841
Khattab, M.M. 73716
+Khazratov, T. 72718
Kheshgi, H.S.+ 72187
Khimich, Yu.P.+ 72717
Khmel'nitskii, A.I.+ 73538
Khodyrev, V.A.+ 72021
+Kholodar', G.A. 72417
Kholodenko, A.L.+ 72333
+Kholodova, L.A. 70748
Khoma, I.Yu. 71391
Khonde, K.+ 72240
Khoo, I.C. 71875
Khoroshun, L.P.+ 71453
Khramov, G.A.+ 71595
+Khudaverdyan, O.M. 69969
+Khudoverdyan, A.M. 71760
+Khusid, B.M. 71570
+Khuzeev, A.P. 71810
+Khwaja, H.A. 72731
Kiang, Y.C.+ 71158
Kibble, B.P. 70076
Kibble, B.P.+ 70075
+Kibbler, A. 73005
+Kidd, G., Jr. 73586
+Kidney, R.L. 73777
+Kido, G. 72306
+Kido, M. 72559
+Kiefer, W. 70886
+Kielkopf, J. 74094
Kien Fam Le .... *see* Fam Le Kien
+Kienzle, W. 70418
Kiflawi, I.+ 73009
Kihlberg, A. 70225
Kijko, A.+ 73724
+Kikuchi, A. 71555
+Kikuchi, K. 72582
Kikuchi, T.+ 73955
Kikuchi, T.+ 73065
+Kikukawa, H. 70344
+Kikukawa, J. 70344
+Kildir, M. 70595
Kileny, P.+ 73582
+Kilmartin, P.M. 74049
+Kim, C.W. 73110
+Kim, J.I. 69798
+Kim, J.T. 73110
+Kim, K.T. 71616
Kim, M.D.+ 71596
Kim, S.+ 73292
+Kim, Yu.A. 73632
+Kim, Y.S. 70309
Kim Chul-Sung .... *see* Chul-Sung Kim
Kim Kwang Bum .... *see* Kwang Bum Kim
Kimel, I. 70386
+Kimel, S. 73354
+Kimura, F. 73480
Kimura, H.+ 73150
+Kimura, K. 70950
+Kimura, M. 70626
Kimura, S.+ 73056
Kimura, T.+ 73346
+King, E.P. 73921
+King, G.C.P. 73743
+King, K.J. 74125
+King, R.C. 70252
+King-Sun Fu 73744
Kingon, A.I.+ 73042
Kingon, A.I.+ 73053
Kinno, S.+ 72827
+Kinoshita, H. 73978
Kinouchi, Y.+ 73685
Kinra, V.K.+ 72052
+Kinra, V.K. 71479
+Kinser, D.L. 72158
Kinzel, W.+ 72624
Kipriyanov, A.A.+ 71849
Kipriyanov, A.A.+ 71850
Kircheva, P.P. 70954
Kirchheim, R. 72159
Kirchner, H.P.+ 73186
+Kirichenko, O.V. 73157
+Kirichenko, V.S. 74009
+Kirihara, T. 73292
+Kirillov, D.A. 70413
Kirillov, V.I.+ 72353
Kirschner, R.+ 70322
+Kirscht, F.-G. 72511
Kirsten, T. 70495
Kirtley, J.R.+ 72871

+Kischko, U. ... 70738
+Kiselev, V.M. ... 71167
+Kiseleva, N.V. ... 72759
Kishi, T.+ ... 73214
+Kishore ... 73225
+Kisker, E. ... 72584
Kislov, A.V ... 73899
Kislukha, N.I.+ ... 72334
+Kiss, L. ... 70143
+Kissinger, R.D. ... 73033
+Kita, H. ... 72492
+Kitagawa, K. ... 70665
Kitamura, N.+ ... 73383
Kito, M.+ ... 73513
+Kiwus, M. ... 72766
Kiyak, S.G. ... 72008
+Kiyono, S. ... 73195
+Kjelberg, I. ... 71790
Klabazna, J. ... 71212
+Klabes, R. ... 72017
+Klaeboe, P. ... 70843
Klapstein, D.+ ... 70937
Klare, G.+ ... 74087
Klauder, J.R.+ ... 70191
+Klaus, M. ... 69904
Klebanov, Ya.M. ... 71395
Klein, G. ... 72311
+Klein, H. ... 70307
Klein, I.E.+ ... 73245
Klein, R.H. ... 69837
Kleinefeld, Th.+ ... 72863
+Kleinfeld, A.M. ... 70577
+Kleinpoppen, H. ... 71011
Klemp, D.+ ... 70933
+Klepper, O. ... 70587
Kleppinger, W.E.+ ... 70544
+Kleppner, D. ... 70796
+Kleshchenko, L.K. ... 73895
+Kleshchev, G.V. ... 72681
+Klewe-Nebenius, H. ... 70606
+Kleyn, A.W. ... 72908
Klimenko, V.A. ... 71920
+Klimke, A. ... 74106
Klimov, A.N.+ ... 73687
+Klimusheva, G.V. ... 71035
Kline, D.M.+ ... 73397
Kling, H.+ ... 70959
Klingenbeck, K.+ ... 70642
+Klinger, J.S. ... 70409
+Klingshirn, C. ... 72325
+Kloch, J. ... 73108
Klopfer, G.H.+ ... 71510
+Klueh, R.L. ... 73148
Kluger, W.+ ... 70679
+Klykov, V.I. ... 72283
+Knapp, G. ... 74129
+Knapp, J.A. ... 72951
+Knechtli, R.C. ... 73442
+Kneppo, P. ... 73559
Knight, C.J. ... 71109
Knox, J.M.+ ... 71221
+Knuyt, G. ... 72884
+Kobakhidze, G.V. ... 72656
+Kobata, T. ... 71781
Kobayashi, H.+ ... 72231
+Kobayashi, H. ... 71255
+Kobayashi, K. ... 72787
Kobayashi, K.L.I.+ ... 72949
Kobayashi, N. ... 71915
Kobayashi, T.+ ... 71078
+Kobayashi, T. ... 71164
+Kobayashiu, H. ... 71152
+Kobekov, V.V. ... 70484
Kobka, V.G.+ ... 72400
+Kobori, Y. ... 71447
Koborov, N.N.+ ... 70148
Koc, Y. ... 69923
Koch, R.A.+ ... 71291
+Koch-Miramond, L. ... 74182
+Kochelayev, B.I. ... 72817
+Kochengina, M.K. ... 72010
Kochenov, I.S. ... 71345
Kochurov, V.P. ... 69879
+Kock, M. ... 70821
+Kock, M. ... 70820
Kodaira, J.+ ... 70398
+Kodaira, K. ... 73041
Koel, G.J. ... 71234
+Koenig, J.L. ... 71908
+Koenig, J.L. ... 71034
Koenigsberger, G.+ ... 74103
+Koestner, R.J. ... 72205
Kofman, L.A. ... 69959
Kogure, Y.+ ... 72069
Kohler, W.E.+ ... 71682
+Kohmura, T. ... 70448
+Kohno, T. ... 69998
Kohoutek, J.+ ... 73482
+Koidan, V.S. ... 71753
+Koiwa, I. ... 73006
+Koizumi, M. ... 73052
+Kojnok, J. ... 72892
+Kojnok, J. ... 72890
+Kojnok, J. ... 72893
+Kojnok, J. ... 72891
Kolassis, C.A. ... 69955
Kolchanova, N.M.+ ... 72354
Kolchin, O.P. ... 73020
Kolesnichenko, A.F. ... 71060
+Kolesnikov, S.S. ... 71632
Koller, J. ... 70205
+Kolmakova, N.P. ... 72645
+Kolochinskii, Yu.Yu. ... 71514
+Kolomets, V.V. ... 72301
+Kolomoets, V.V. ... 72396
+Koltai, F. ... 72278
Koltai, M.+ ... 72281
+Kol'tsov, V.B. ... 72399
Komar, A. ... 69944
+Komarov, A.V. ... 72430
Komatsu, H. ... 71917
+Komatsu, M. ... 71258
+Komatsu, Y. ... 73437
+Komirenko, R.P. ... 72400
+Komissarova, B.A. ... 72718
+Komissarova, G.L. ... 71457
+Komissarova, I.I. ... 70128
Komolov, S.A. ... 72904
+Komornicki, A. ... 70763
+Komotori, K. ... 71658
+Kompanets, I.N. ... 72869
+Komura, Y. ... 71982
Komuro, M.+ ... 70145
+Komuro, S. ... 72329
Konczewicz, L.+ ... 72348
+Kondo, H. ... 72582
+Kondo, T. ... 73876
+Kondo, Y. ... 74113
+Kondrashova, L.I. ... 70161
+Kondratenko, A.N. ... 71712
Kone, B.+ ... 70917
+Konfederatenko, V.I. ... 70553
+Kong, J.A. ... 71229
+Kong Guanglin ... 72846
+Konicek, J. ... 70485
+Konig, A. ... 71815
Konig, J.+ ... 73493
Konig, U.+ ... 72253
+Konijn, J. ... 70631
Koning, C. ... 70675
+Konnerth, D. ... 70623
Konno, H. ... 72539
+Kono, S. ... 72499
Kononenko, Ye.V.+ ... 73515
Konorov, P.P. ... 72507
Konov, V.I. ... 71757
Konov, V.I.+ ... 73335
+Konov, V.I. ... 71758
+Konozenko, I.D. ... 72003
+Konstantinov, I.E. ... 74055
+Konstantinova, N.N. ... 72420
+Kontrosh, E.E. ... 70754
+Kopanov, V.D. ... 70053
Kopasov, A.P.+ ... 72469
Kopec, T.K.+ ... 72627
Kopeliovich, V.B. ... 70516
+Kopke, P. ... 73889
Kopnichev, Yu.F. ... 73936
Kopsky, V. ... 72077
Kopylov, A.A. ... 72308
+Korablev, V.V. ... 72899
+Korableva, T.P. ... 72185
Koralewski, M.+ ... 72762
+Koranyi, T. ... 72282
+Korbutyak, D.V. ... 72848
Koren, U.+ ... 71119
+Korenowski, G.M. ... 70973
+Korn, E. ... 70835
+Kornelsen, K.E. ... 72179
Kornev, Yu.V.+ ... 72518
+Kornienko, L.S. ... 71159
Kornienko, M.E.+ ... 71179
Kornienko, N.E.+ ... 71184
+Kornilov, V.A. ... 70553
+Kornyushin, S.I. ... 72506
+Kornyushin, Y.V. ... 72115
+Kornyushin, Yu.V. ... 72400
+Korobeinikov, V.P. ... 71603
+Korolev, G.A. ... 70408
Korolev, V.B.+ ... 71670
+Korolev, V.V. ... 70748
+Korolev, Yu.D. ... 71810
+Korolyuk, S.L. ... 72428
+Korolyuk, S.S. ... 72396
+Korostelin, Yu.I. ... 72044
+Korotkikh, V.L. ... 72940
+Korotkova, V.A. ... 73099
+Korsukova, M.M. ... 72979
+Korsunskii, L.M. ... 71670
+Kortel', A.A. ... 72185
Kortov, V.S.+ ... 72971
Kortz, H.P. ... 71156
+Koryakova, V.S. ... 71929
+Kosarev, I.G. ... 70413
+Kosasih, U. ... 73176
Kosevich, A.M.+ ... 72454
Koshigoe, S.+ ... 73585
+Kosin, V.I. ... 73029
+Koslova, N.M. ... 73542
+Koslowsky, V.T. ... 70506
Kosmodamians'kii, O.S.+ ... 71437
+Kosov, B.D. ... 73160
+Koster, R. ... 70673
+Koster, R. ... 70679
Koster, U.+ ... 72131
+Kostic, V. ... 73189
Kostin, V.K.+ ... 71565
+Kostitsin, E.G. ... 71946
+Kostko, V.S. ... 73353
+Kostoglotov, A.I. ... 71451
+Kostornov, A.G. ... 73157
Kostromin, B.F.+ ... 72169
Kostyshin, M.T.+ ... 73353
+Kostyukov, V.I. ... 73029
+Kostyukov, V.V. ... 73891
+Kotani, T. ... 70504
Kotarska, K.+ ... 73412
+Kotarski, Z. ... 73412
+Kothari, L.S. ... 70643
+Kotiveerachari, B. ... 73224
+Kotov, A.A. ... 70633
Kotrikadze, N.G.+ ... 73535
Kou, S.+ ... 73275
+Kounadis, A.N. ... 71444
Kouri, D.J.+ ... 72914
Kourov, N.I.+ ... 72617
+Koutecky, J. ... 71045
+Koutitonsky, V.G. ... 73824
Koutroulos, C.G. ... 70188
Koutroulos, C.G. ... 70250
+Kouzov, A.P. ... 70943
+Kovach, D.Sh. ... 72751
Kovachev, V. ... 72543
Kovacs, I. ... 70759
+Kovacs, R.M. ... 70143
Koval, A.G.+ ... 73382
Koval'chenko, M.S.+ ... 73057
Koval'chuk, L.P.+ ... 73634
+Kovalev, A.I. ... 70542
Kovalev, A.S.+ ... 71820
Kovalev, V.N.+ ... 71794
+Kovalev, V.N. ... 72144
+Kovalik, A. ... 70833
+Kovardakova, G.N. ... 72478
+Kovats, M. ... 72890
Kovbasenko, Yu.P. ... 71051
Kover, L.+ ... 72963
+Kowal, C. ... 74046
+Kowalska, J. ... 72290
+Kowalski, L. ... 70595
+Kowalski, L. ... 70578
Kowalski, M.P.+ ... 74161
+Kowalski, S. ... 70449
Kowalski, Z.W. ... 73241
Kowelewski, J.J. ... 71300
+Koyama, T. ... 73041
+Koyama, Y. ... 73513
Koyanagi, K.+ ... 70129
+Koyanagi, M. ... 70078
+Koyanagi, M. ... 71257
Koyanagi, W.+ ... 73191
Kozai, Y.+ ... 74048
Kozak, A.de ... *see* de Kozak, A.
+Kozakai, T. ... 73064
+Kozhanov, V.A. ... 72033
Kozhukharov, V.+ ... 71888
Kozin, F.+ ... 71471
+Kozlov, A.M. ... 73107
Kozlov, I.A.+ ... 73162
+Kozlov, S.V. ... 71453
+Kozlowski, A. ... 71884
+Kozlowski, G. ... 72627
Kozuchowski, K. ... 73853
+Krabiell, A. ... 70694
+Kracikova, T.I. ... 70485
Kraeft, W.D.+ ... 71694
+Kraft, O.E. ... 70484
+Krajewski, T. ... 72738
Kralchevski, P.A.+ ... 70361
Kramar, G.P.+ ... 72728
+Kramer, B. ... 72752
+Kraner, H.W. ... 72522
Kranz, E. ... 71802
Krashakov, S.A.+ ... 71111
+Krashchenko, V.P. ... 73160
+Krasnenko, N.P. ... 73952
+Krasnik, I.L. ... 73404
+Krason, P. ... 71057
+Krasovitskii, V.B. ... 71716
+Krasovitskii, V.B. ... 71751
+Krastev, V.R. ... 70413
Krasyuk, B.A.+ ... 72485
+Kratsikova, T.I. ... 70426
+Kratsikova, T.I. ... 70427
+Kratt, E.P. ... 73029
+Kratz, J.V. ... 70612
+Kraus, B. ... 73393
+Kraus, R.H., Jr. ... 70624
Krause, C.R. ... 73702
+Krause, D. ... 72131
Krause, M.O.+ ... 70832
+Krauser, J. ... 71225
+Kraushaar, W.L. ... 74184
+Krauss, R.M. ... 73606
Krautter, A.+ ... 74167
+Kravchenko, V.P. ... 72177
Kravchuk, A.S. ... 71488
Kravtsov, Yu.A.+ ... 71075
Krebs, K.H. ... 70150
Kreindel', Yu.E.+ ... 70152
+Kreissl, A. ... 72325
+Kremer, R. ... 72670
Krenek, P. ... 71685
+Krentsis, R.P. ... 72402
+Kreusing, H. ... 73394
+Krikis, Yu.Yu. ... 71959
Krikorian, O.H. ... 73267
+Krinsley, D.H. ... 74030
Krisch, J.P. ... 69946
+Krishna Reddy, B.G. ... 73224
Krishna Swamy, K.S. ... 70848
+Krishnaiah, A. ... 72048
Krishnamoorthy, C.R.+ ... 70873
+Krishnamoorthy, S. ... 73096
Krishnani, P.D. ... 70708
Krishnaswamy, M.R.+ ... 73997
+Kriss, G.A. ... 74069
+Kristoffersen, K. ... 73647
Kritchman, E.M. ... 73417
Kritchman, E.M.+ ... 73424
Kritz, M.A. ... 73870
+Krivenko, T.A. ... 69810
Krivine, H.+ ... 70476
+Krivonogov, V.G. ... 71405
+Krivoshein, V.L. ... 70747
Kroenke, L.W.+ ... 73785
+Krogulski, T. ... 70631
+Krohn, B.J. ... 70838
+Krompholz, H. ... 71807
+Kroning, M. ... 70691
+Kronmuller, H. ... 73116
+Kroo, N. ... 71903
Krotkus, A.+ ... 72409
Krueger, B.K.+ ... 73539
+Krug, F. ... 70623
+Krug, W.P. ... 70936
+Kruglov, S.P. ... 70542
Kruglov, V.F.+ ... 72681
+Kruglyashov, S.B. ... 72633
+Krumbach, V. ... 70785
Krummacher, S.+ ... 70829
+Krupnov, A.F. ... 70854
Krupski, J.+ ... 72350
Kruscha, K.J.G.+ ... 71712
+Kruse, H. ... 70605
Krusi, P.+ ... 71211
Kruszewski, J.+ ... 71218
Kruszewski, J.+ ... 71219
Kruszewski, J.+ ... 71215
Krutikov, V.A.+ ... 71074
+Krylov, L.I. ... 70671
Krylova, I.V.+ ... 72943
+Krys'ko, V.A. ... 71359
+Kryszewski, M. ... 72110
+Kryukov, M.M. ... 71376
+Kryukova, L.N. ... 72718
+Kshnyakin, V.S. ... 73105
+Ksiazek, J. ... 71279
+Ktitorov, S.A. ... 72330
Ku Yoon Young ... *see* Young Ku Yoon
Kuang Zhen-bang ... 71461
Kuang-chao Chou ... *see* Chou Kuang-chao
Kubelka, J.+ ... 71131
Kubenko, V.D.+ ... 71458
Kubicek, P.+ ... 72146
Kubo, H.+ ... 72682
+Kubo, H. ... 72683
+Kubodera, H. ... 70920
+Kubota, T. ... 72231
+Kudin, L.G. ... 70552
+Kudinova, M.A. ... 70958
+Kudinova, M.A. ... 71167
+Kudriavtseva, A.D. ... 71089
Kudryashov, N.A.+ ... 71641
Kudryashova, I.Ya.+ ... 72519
+Kudryavtsev, E.M. ... 71105
+Kuhl, J. ... 71123
Kuhlke, D.+ ... 71151
Kuhlmann-Wilsdorf, D.+ ... 73232
Kuhn, A.T.+ ... 72114
Kuhn, A.T.+ ... 72116
Kuhn, A.T.+ ... 73014
+Kuhn, W. ... 70575
+Kuhn, W. ... 70638
+Kuhn, W. ... 70594
+Kuivalainen, P. ... 72332
Kukolich, S.G. ... 71036
+Kukolich, S.G. ... 70850
+Kukushkin, I.V. ... 72324
Kulagin, N.A. ... 70806
+Kulakov, B.A. ... 70413
+Kulakov, D.M. ... 71795
+Kulakovskii, V.D. ... 72324
+Kulbardis, A.A. ... 70542
+Kulevskii, L.A. ... 71143
+Kulikov, A.V. ... 70408
+Kulikov, V.I. ... 72015
+Kulikov, V.V. ... 72639
Kulikovskii, A.G. ... 71579
+Kulikovskii, V.Yu. ... 72906
+Kulina, P. ... 70813
Kulkarni, S.B. ... 73300
+Kul'kov, V.D. ... 72706
+Kul'kov, V.D. ... 72708
+Kul'kov, V.D. ... 72707
+Kullander, S. ... 70408
+Kullgren, T.E. ... 71476
Kullmann, J.+ ... 70134
Kulshreshtha, D.S. ... 70329
Kulshreshtha, D.S. ... 70341
Kumakura, M.+ ... 73137
Kumanori, T.+ ... 74049
Kumar, A.+ ... 71746
Kumar, C.K.+ ... 74148
Kumar, I.+ ... 70501
Kumar, P.+ ... 71145
Kumar, S.+ ... 70190
Kumar, S.+ ... 70239
Kumar, V. ... 70513
Kumari, M.S.+ ... 72098
Kumari, M.S.+ ... 72099
Kumashiro, Y. ... 72974
+Kumpulainen, J. ... 70488
+Kumra, M.S. ... 70669
+Kumskova, I.K. ... 72051
+Kunick, A. ... 69925
+Kunnemeyer, R. ... 70820
+Kuno, H. ... 73061
Kunz, A.B.+ ... 72829
Kunz, S.C.+ ... 73189
Kunz, W.+ ... 72168
Kuo-Mei Chen+ ... 70968
+Kupferman, P.N. ... 74123
+Kuppler, D. ... 70690
+Kuprin, S.P. ... 73555
+Kupryazhkin, A.Ya. ... 70140
+Kurata, M. ... 73193
+Kurauchi, T. ... 73166
Kuribara, M.+ ... 71241
+Kuribayashi, K. ... 73437
+Kurilenko, A.A. ... 71632
+Kurita, M. ... 70661
+Kurita, S. ... 71257
Kuriyama, A.+ ... 70467
+Kurmoo, M. ... 72065
+Kurnaev, V.A. ... 70148
Kuroiwa, K. ... 71310
Kuroiwa, K. ... 71322
+Kurokawa, H. ... 72157
+Kuropatkin, N.P. ... 70552
Kushch, V.I.+ ... 71335
+Kushkov, V.K. ... 72257
Kuskov, O.L. ... 73771
+Kusner, Yu.S. ... 70139
+Kusuda, T. ... 73480
+Kusy, R.P. ... 72111
+Kuuskraa, V.A. ... 73396
+Kuvaga, I.L. ... 70486
+Kuwae, A. ... 70888
+Kuz'ma, Yu.B. ... 73069
+Kuz'min, N.A. ... 70413
+Kuzmin, V.A. ... 74193
+Kuznetsov, A.N. ... 73627
Kuznetsov, E.A. ... 71493
+Kuznetsov, S.P. ... 72759
+Kuznetsov, V.V. ... 70500
+Kuznetsov, Yu.V. ... 70671
Kuznetsova, L.P.+ ... 73893
+Kuznetsova, S.V. ... 71029
+Kuznetsova, S.V. ... 73351
Kuzovkov, Yu.I.+ ... 71326
+Kuzyan, R.O. ... 72535
+Kvasman, N.M. ... 72177
Kveder, V.V.+ ... 72425
+Kwang Bum Kim ... 73274
+Kwiatkowski, K. ... 70609
+Kwiecinski, G.G. ... 73561
Kwizera, P.+ ... 72781
+Kylander, J. ... 71253
Kyong Moon Hee ... *see* Hee Kyong Moon
+Kyrs, M. ... 70668
Kyung-Joung Lee+ ... 73551
+Kyvelos, B. ... 72644

la Guillaume, C.Benoit a ... *see* Benoit a la Guillaume, C.
+La Mar, G.N. ... 70909
+La Rana, G. ... 70635
la Vaissiere, C.de ... *see* de la Vaissiere, C.
+Laane, J. ... 70863
+Lacaze, R. ... 70337
Lachenbruch, A.H.+ ... 73762
+Lackner, K. ... 71749
Lacombe, M.+ ... 70404
+Lacombe, P. ... 74081
+Lacquaniti, V. ... 70079
+Lada, C.J. ... 74131
Laermann, K.-H. ... 71387
Laermans, C.+ ... 72575
+Laflere, W.H. ... 72732
+Lafont, R. ... 73301
+Lagana', A. ... 73315
+Lagana, A. ... 73316
Laganelli, A.L.+ ... 71594
+Lago, B. ... 73757

+Lagrange, P. 72561
+Lagreca, M...............71828
+Lagreca, M...............71829
Lagushenko, R.+ 71822
Lahanas, A.B...............70284
+Lahaye, J. 73439
Lahee, A.M.+ 72199
+Lahiri, S.C...............73324
+Lahiry, S.................72642
+Lahmer, W. 70621
+Lahoti, G.D. 73151
+Lai, A.......................70914
+Lai, C.C...................71096
Lai, C.H.+ 70410
+Laine, R...................74042
+Laitinen, H.A. 72255
+Lake, K....................74167
Lakhin, V.N.+ 71070
Lakshman, S.V.J.+ 71115
+Lakshmanan, S.........73466
Lakshmi Bala, S.+ 70308
Lakshmi Bala, S.+ 70401
Lakshmi Bala, S.+ 70402
+Lakshminarasimha, C.S...71826
+Lakshminarayana, D...72978
Laktionov, A.G............73902
+Lal, K.......................73285
Lal, M........................71379
Lalas, D.P.+ 73401
Lalou, C.+ 73784
Lam Chan F. ....see Chan F. Lam
Lambda, O.P.+ 72779
Lambert, G.D.+..........73666
+Lambert, M. 70408
Lambert, R.F..............71262
Lambert, R.F..............71281
Lamekin, P.I.+...........71168
Lami, A.+ 70965
Lamothe, M.+............73797
Lamoureux, M.+ 71704
+Lancelot, J.R. 73754
Lanchon, H.+.............72192
+Lande, K..................70274
+Lande, K..................70745
+Landgren, G. 72955
Landman, U. 73366
+Lando, D..................73465
Landolt, A.U. 74118
Landsberg, B.M.+ 70852
Landuyt, J.van ....see van Landuyt, J.
Lang, E.+ 72205
Lang, M.L.+ 72744
Lang, N.D. 72246
Lang, N.D.+ 72918
+Lang, R.W................71158
Langan, R.T.+ 73761
Lange, F.F.+ 73100
+Lange, H..................71812
+Langer, G. 70143
+Langer, G. 70144
+Langer, G. 70071
+Langeron, J.P. 72895
Langeveld, A.D.van ....see van Langeveld, A.D.
+Langeveld, W.G.J.....70414
+Langevin, M. 70445
+Langevin, M. 71030
+Langler, R.F.............70778
+Langley, D.S............71272
+Langouche, F...........69930
+Lanin, A.G...............73208
+Lankford, A.J. 70399
+Lankford, J...............71483
Lanying Lin ....see Lin Lanying
Lanzi, O.+.................71686
+Lapedes, A...............74195
+Lapeyre, G.J............72951
Lapierre, Y.................71720
+Lapierre, Y. 71800
+Lapina, M.I. 73758
+Lapujoulade, J..........72927
+Larikov, L.N............72142
+Larin, S.A................70202
Larkey, L.S.................71312
+Larsen, P.K..............71222
+Larsen, R.R. 70399
Larsen, S.A.+.............70058
Larsen, V.V.+ 70674
+Larson, H.P. 74034
+Larson, H.P. 74133
Larson, S.M.+ 74052
Larsson, M.+ 70955
+LaRue, A..................73583
+Laser, M. 70663
Lash, R.J. 73013
+Lashkevich, E.G. 72848
+Lashkevich, V.I. 72262
Lashkov, Yu.A.+ 71624
+Laspalles, C. 70753
+Lastras-Martinez, A...72752
+Laszlo, J...................72933
+Laszlo, J...................72932
+Lataitis, R.J.............71284
+Latham, D.W. 74152
Lattanzi, F.+ 70874
Laub, S. 71819
+Laue, E.D. 70913
Laughlin, R.B.............72335
+Laukhin, V.N. 72381
+Launois, H...............72521
Laura, P.A.A.+ 71327
Laura, P.A.A.+ 71304
Laurent, B.+ 73458
Laurent, J.+ 73927
Lauriat, J.-P. 71880
+Laurich, B................72322
Lauro, C.di ..see di Lauro, C.
+Lautrup, B. 70249
+Lauwers, P.G...........70213
+Laval, J.-P. 71950
+Lavrent'ev, V.V. 73516
Lavrinenko, A.V.+......72591
+Law, D.J. 73651
Lawandy, N.M.+........71679
+Lawin, H..................70452
+Lawn, B.R................73180
+Lawrence, W.T.........73799
+Lawson, R.D............70440
Lazarev, L.M. 70546
Lazarev, L.N.+ 70671
+Lazareva, V.T..........70929
Lazarides, G.+ 70291
+Le, Y.P....................73275
+Le Bars, R. 73674
+Le Bosse, J.C. 72476
+Le Bosse, J.C. 71841
+Le Caer, G...............71892
+le Calve, J. 70897
Le Douaron, A.+ 73301
+le Du, P...................70418
+Le Gressus, C. 72835
Le Kien Fam ....see Fam Le Kien
+Le Sergent, C...........71235
Lea, C.+ 73089
Lea, K.R....................70733
Leach, P.W.+.............73229
+Leach, R.N..............74030
+Leahy, D.................74096
+Leamy, H.J..............70151
+Leatherman, G.L......73270
Leavitt, R.P.+ 71132
Lebedev, A.A.+ 73308
+Lebedev, A.A...........72001
+Lebedev, A.T...........70031
+Lebedev, V.M...........70530
Lebedev, V.P.+ 73240
Lebedev, Ya.D.+ 72450
+Lebedeva, I.B...........71634
+Leboeuf, J.N............71743
Lebofsky, M.J.+ 74098
+Lebovka, N.I. 70902
+Lebowitz, J.L...........72621
+Lebrun, D. 70607
+Lecante, J. 72964
+Lecayon, G. 72835
Leckie, D.A.+ 73845
+LeClaire, B. 70399
+Leclert, G................71725
+LeComber, P.G. 72698
Ledinegg, E.+ 71063
Ledneva, N.N.+..........70141
Lee, A.R.+ 71317
+Lee, C.K. 70274
+Lee, C.K. 70745
Lee, D.+ 70960
Lee, D.+ 71269
+Lee, D.S..................72414
+Lee, G.F..................71320
Lee, H.+....................70888
Lee, H.+....................71677
+Lee, H.K.................73110
+Lee, I.Y...................70441
+Lee, I.Y...................70597
+Lee, I.Y...................70608
Lee, J.+ 70893
+Lee, J. 70892
+Lee, J. 70887
+Lee, J.C...................71357
+Lee, K. 73110
+Lee, L.C...................70944
+Lee, P.H.Y...............71745
+Lee, S......................71774
+Lee, S.A...................73924
+Lee, S.-C..................70224
+Lee, S.H...................73139
Lee, S.W.+.................74031
Lee, T.-S. H...............70459
+Lee, Y.C. 69913
+Lee, Y.-T. 73152
Lee Ching-Yieh ....see Ching-Yieh Lee
Lee Dong-ho ....see Dong-ho Lee
Lee Ju-Ik .... see Ju-Ik Lee
Lee Kyung-Joung ....see Kyung-Joung Lee
Lee Myoung-Ho ....see Myoung-Ho Lee
+Leeper, R.J. 70737
+Lefebvre, J...............72794
+Lefebvre, J...............71882
+Lefevre, H.C............71246
+Lefort, M..................70592
+Lefort, M..................70603
+Lefrancois, J. 70418
+Legare, P. 72235
+Legge, R.N...............73455
Legowski, S.+ 70825
+Legowski, S. 72337
Legters, G.R.+...........73810
+Leguillon, D.............71392
Lehmberg, R.H. 71181
+Lehmkuhle, S. 73579
+Lehner, T.................71800
+Lehtinen, P. 70683
+Lei Guo-pu 71412
Lei Lin................ see Lin Lei
+Leibler, S. 72184
+Leibler, S. 72228
+Leigh, I.C. 73311
Leipholz, H.H.E.+......71354
+Leitao, M.J..............73904
+Leitch, M.J...............70543
Leitner, A.+ 71100
+Lejay, P...................71942
+Lejcek, L.................71871
+Leleux, P.................70414
+Lemaire, M.C...........70753
+Lemaitre, M.-P.........73927
+Lematre, J. 71869
+Lembege, B.............71743
+Lemmer, R.H. 70572
+Lemstra, P.J. 72687
+Lennox, A.J. 70409
Lenschow, D.H.+.......73874
Lenz, E.+ 73286
Leon, F.A.+ 72296
Leonard, C.+ 71907
+Leonardis, B. 72075
+Leone, S.R...............70995
+Leont'ev, A.I............71656
Leont'ev, V.M.+ 71157
Leplin, J.....................69852
+Lerat, J.-M. 70707
+Leray, S. 70635
+Leray, Th. 70418
+Lerouille, J...............72842
+Leroux Hugon, P......72861
Lesage, P. 70037
+Lesan, W. 72114
+Lesan, W.A.............72116
LeSar, R.+ 71938
+Lescov, L.V.............73075
+Leshchenko, D.D......69872
+Lesk, I.A..................73455
+Leslie, D.R..............70908
+Leung, L.-W.S.........73558
Leutwyler, S.+ 70890
+Levasseur, A............72822
+Levelut, A................72546
Leven, R.+ 71815
Levenson, L.L............72897
+Leventhal, M. 74134
Leveque, G.+ 72833
+Lever, D.A...............70651
+Levi, C. 73024
+Levi, M. 70399
Levin, V.M. 71671
Levine, I.....................73708
+Levine, L.H. 74063
+LeVine, M.J.............70620
Levine, R.D. 70571
+Levine, R.D. 69938
+Levine, S.N..............72444
+Levins, D.M.............70681
Levit, V.I.+ 71956
Levitin, R.Z.+.............72680
Levy, C.+ 71472
+Levy, D.H................70938
+Levy, F....................72810
+Lewandowska-Marciniak, H................................73723
Lewandowski, M. 73751
+Lewin, W.H.G..........74109
+Lewis, C.H...............71596
+Lewis, L.J. 73422
+Lewis, R.A..............70405
Lewis, T.J. 70755
+Lhenoret, P..............70635
+L'hote, D..................70753
l'Huillier, A.+ 70831
Li, A.+ 71477
Li, C.K.N.+ 73547
+Li, D........................73149
+Li, E.K.H..................73547
Li, F.+ 70892
+Li, F. 70893
Li, J.K.-J. 73677
Li, K.K.+ 71153
Li, S.P.+....................70313
+Li Guo-Dong 72638
+Li Junxiang..............71028
+Li Junxiang..............71031
Li Li+........................71028
+Li Li........................71031
Li Li..........................see Li Li
Li Mingguang+ 71031
+Li Mingguang...........71028
Li Tie-cheng 70004
Li Tiecheng+ 69976
+Li Xiang-ting...........72152
+Li Yang-guo 69937
Li Yung-gui+ 70110
Li Yung-gui+ 71173
Li-jing Wu.....see Wu Li-jing
Li-wei Zhou ....see Zhou Li-wei
Li-zhi Fang...see Fang Li-zhi
Lian Tan Swee ....see Swee Lian Tan
Lian-gen Sheng ....see Sheng Lian-gen
+Liang, C..................72153
Liang-yu Wang ....see Wang Liang-yu
+Liao, P.F..................71182
+Libby, L.M. 74063
Libchaber, A.+ 71518
+Libenson, M.N. 73255
+Libenson, M.N. 72010
+Libenson, M.N. 73345
+Librant, Z.M.............73304
+Lichten, S.M............74126
+Lichtman, D. 72896
+Lideikis, T...............72409
+Lie, H.-J. 73824
+Lieb, E.H.................71104
+Lieb, K.P. 70577
Liebermann, H.+ 73078
+Liebert, A. 73286
Liechtenstein, A.I.+....72603
+Lieder, R.M.............70432
+Liegois, M...............71235
+Lieske, J.H...............74004
+Lievin, J. 73357
+Light, J.C.................72224
+Light, J.C.................70970
+Liguori, C. 70383
+Liguori, C. 70499
Liid'ya, G. 72843
Lijun Wang . see Wang Lijun
+Likens, G.E..............73868
+Likhachev, M.F........70413
Likhachev, V.N...........71598
+Likhter, V.A. 71631
Liller, M.H.................74121
+Lilley, J.S................70622
Lillo, S.De ....see De Lillo, S.
+Lim, T.....................73301
Limbach, H.-H.+ 70861
+Limburg, J...............73347
+Lin, M.R..................71962
Lin, P.S.D.+...............70151
Lin, Y.K.+ 71470
+Lin cheng-lu 72013
+Lin Lanying.............72846
+Lin Lei 72105
+Lin Peiwen...............69976
+Lin Wen-Gui 72638
Lin Yong-hua+ 71952
Lin Zhang-da+ 73434
+Lin Zhang-da...........73361
Lin-xiao Ge ..see Ge Lin-xiao
+Lind, R.C.................71202
+Lindau, I..................73239
+Lindau, I..................70734
+Lindau, I..................72305
Lindau, M.+ 73514
Lindauer, G.+ 72235
+Lindberg, J.B...........71291
+Lindenberg, K..........69987
+Linder, B.................70978
+Lindgren, I...............70802
Lindgren, T. 71722
+Lindholm, F.A..........72443
+Lindkvist, B. 70611
+Lindroos, V.K...........71975
+Lineberger, W.C.......70947
Lines, M.E.................71881
+Linfield, R.P............74176
+Ling, S.C..................71987
+Ling, S.C..................71994
+Ling, S.C..................72272
+Ling, S.C..................71992
Ling Yin-sheng............70469
Lingart, Yu.K.+ 72981
Lingner, C.+ 72030
+Linke, J....................72165
+Linse, V.D. 73022
Liou Fu-Tai..see Fu-Tai Liou
+Lipas, P.O...............70488
+Lipatov, L.N.............70322
Lipatov, Yu.S.+ 71878
+Lipinski, A...............72523
Lipinski, W.+..............71057
Lipkin, H.J. 70336
+Lipkin, M.................70997
+Lippens, C...............73927
Lippincott, S.L. 74112
+Lippitsch, M.E. 71100
Lipps, F.W..................71343
+Lipsett, J.J...............70720
+Lisini, A...................70773
Lisitsa, M.P.+ 72867
Lisy, V.+ 69909
Lisy, V.+ 71647
+Litovitz, T.A.............71508
+Litovskaya, T.I. 73047
+Litt, B.R...................69907
Litterst, F.J.+ 72719
+Little, T.S. 70885
+Littlewood, R............71832
+Litton, C.W. 71983
+Litvak, M.M.............71593
+Litvin, F.F................73541
+Litvinchuk, A.P. 72314
Litvinov, I.V. 73504
Litvinov, V.G.+...........71349
+Litwin-Staszewska, E...72348
+Liu, K......................70971
+Liu Chun-yang 71497
Liu Hsi-Ho ...see Hsi-Ho Liu
Liu Peng-fei ....see Peng-fei Liu
+Liu Shu-zhen 71952
Liu Wing Kam ....see Wing Kam Liu
+Liu Xue-hui 71460
Liu Yan-Zhu 71346
+Liu Yong-zhen..........74188
+Liu Zhen-xing...........72528
Liu Zhi-yi+ 72528
+Livage, J. 72397
+Liversage, W.E........73666
+Livshits, M...............74062
Lizzi, F.L.+ 73648
+Ljolje, K...................70811
+Ljolje, K...................70812
+Llewellyn Smith, C.H...70392
+Lo, S.Y....................70410
+Lo Iudice, N. 70446
Lo Surdo, C................71710
+Lo Vecchio, G. 72620
Lobbezoo, C.J.+ 70676
+Lobodenko, A.A. 70552
+Lockington, N.A. 73271
+Lockyer, N...............70399
Lodenquai, J.+ 74192
+Lodwick, G.D. 73705
+Lofqvist, A...............71311
+Logan, D.................70595
+Logan, D.................70578
+Logan, R.A..............71225
+Logan, R.A..............72435
+Logan, R.A..............72950
+Loggins, C.D. 71263
Loh, C.H. 73601
+Lohberg, J................72080
Lohe, D.+...................73129
+Lohner, T.................71997
+Loiseau, B................70404
+Lokken, R.O.............70648
+Lombardo, U. 70471
+Lomidze, N.L. 70413
+Lompre, L.A.............70831
+Lomsadze, B.A. 73535
+London, R.E. 70903
+Lone, M.A. 70431
Long, A.P.+ 72398
+Long, B.F.................73803
+Long, G.H. 73768
+Longoni, A...............70118
Loo, F.van.....see van Loo, F.
Loo, R.Y.+ 73442
Loosli, H.H.................73935
+Lopata, V.J..............72778
+Lopatin, I.V..............70542
Lopes, R.+ 74024
+Lopes Da Silva, F.H...73558
Lopez, J.+ 71841
+Lopez, J. 72476
Lopez, J.M.+ 72123
+Loponen, M.T...........72605
Lorenzen, C.-J.+.........70801
+Loreti, M. 70368
Lorosch, J.+ 72822
+Loshchenko, V.A......70484
+Louedec, C...............70368
Louis, J.F.+.................73861
+Lounis, A. 70607
+Lousa, A. 72497
Louter, G.J.+ 70137
+Lovas, F.J. 70867
Lovas, R.G.+..............70522
+Lovas, R.G...............70456
+Love, A. 72538
+Love, D.J.G. 70442
+Love, S.T. 70248
Loveland, W.+ 70624
Low, M.J.D.+ 72812
Lowell, J. 72479
+Lowenau, J.P. 72325
+Lowy, J. 73530
+Lozano, M. 70524
+Lozhechnik, V.V.......73019
Lozhechnikov, E.B.+ ..73019
Lozovskii, V.N.+.........72986
Lozovskii, V.N.+.........72273
+Lu, J.J.....................70585
Lu, N.Chau-Chun ....see Chau-Chun Lu, N.
Lu Chih-Yuan ....see Chih-Yuan Lu
Lu Zhong-ming 71351
Lubimova, E.A.+ 73772

Lubliner, J. 69868
+Lubman, D.M. 70149
+Lucas, B. 70753
+Lucas, J. 72838
+Lucas, J. 71898
Lucas, R.+ 70612
+Lucas, R. 70635
Lucazeau, G.+ 71912
Lucchini, E.+ 73059
Lucchitta, B.K. 74026
+Lucci, A. 71900
+Luches, A. 71108
+Lucio M, J.L. 70381
+Ludeke, R. 72955
Luderer, A.A.+ 73629
+Ludewigt, B. 70594
+Ludgate, G.A. 70539
+Ludwig, H.W. 70414
+Ludwig, W.J. 73763
Luft, H.+ 72671
+Lugovskaya, E.S. 72760
+Lui, Y.-W. 70618
+Lukac, C.F. 73999
Lukanin, A.I.+ 72599
+Lukasiak, A. 70599
+Lukat, K. 72848
Luker, L.Dwight .. *see* Dwight Luker, L.
Lukierski, J.+ 70263
+Lukiyanova, L.E. 73897
Luk'yanov, L.G.+ 73981
+Lund, A. 72673
+Lund, L. 71144
+Lund, M. 71253
+Lund, P.D. 70740
+Lundqwist, R. 70701
Luntz, A.+ 72200
+Luomajarvi, M. 72014
+Luontama, M. 70488
+Lushchik, O.N. 71360
+Luth, H. 72905
+Luth, V. 70399
+Luthi, B. 72030
Lutman, M.E. 73681
+Lutsiv, R.V. 72403
+Luty, F. 72839
Luz, G.A.+ 71301
+Luzzi, D.E. 71962
+Luzzi, G. 73387
Lyakhov, G.A.+ 71877
+Lyakhovitskaya, V.A. 72739
+Lyakov, G.A. 71285
+Lyapin, A.A. 71794
+Lyashenko, V.I. 70751
Lyashkevich, I.M.+ 71344
Lykakh, V.A.+ 72677
+Lykken, J. 69968
Lykov, S.N.+ 72134
Lyle, F.F., Jr. 73263
+Lynch, D.W. 72831
+Lynch, D.W. 72833
+Lynch, W.G. 70535
+Lynch, W.G. 70604
+Lynen, U. 70594
+Lynen, U. 70576
+Lynen, U. 70587
+Lynen, U. 70612
Lynn, J.W.+ 72616
Lyon, R.H. 71298
Lyons, P.B.+ 70728
Lyons, R.B.+ 73495
Lyrio, A.A.+ 71532
+Lysochenko, S.V. 72505
+Lytle, F.W. 71891
+Lyubarskii, S.V. 72717
+Lyubimov, A.L. 70413
+Lyublin, B.V. 71793

M., E.Carrasquillo .... *see* Carrasquillo M., E.
M, J.L.Lucio .... *see* Lucio M, J.L.
M. Hua Hsichun .... *see* Hsichun M. Hua
+Ma, T.P 72502
Ma Dong-ping+ 72359
Ma Fuding .... *see* Fuding Ma
Ma Yau-wen 69889
Maas, J.+ 73111
+McAdam, R.J.W. 71531
+McAffer, N.T.C. 70721
+McBay, E.H. 73323
+McCabe, R.W. 72247
McCammon, D.+ 74184
+McCann, S.B. 73845
+McCarroll, W.H. 72393
+McCauley, J.F. 74025
McClain, B.+ 70171
McClain, C.R.+ 73943
McCloskey, M. 69847
McCormick, M.P. 73911
McCormick, P.G. 73423
McCoy, B.M.+ 72569
McCoy, J.K. 73097
+MacCrone, R.K. 73270
+McCrosky, R.E. 74053
+McCrosky, R.E. 74051
+McCubbin, T.K., Jr. 70868
McDaniel, S.T.+ 71289
+McDaniel, S.T. 71269
McDaniel, T.W.+ 71048
+McDermott, D.P. 70866
McDermott, P.N.+ 74099
MacDonald, J. 74077
+Macdonald, J.A. 70371
MacDonald, K.R.+ 71192
MacDonald, M.+ 70934
+McDonald, M.L. 72130
Macdonald, N. 70059
+Macdonald, N.H. 73606
+McDowell, M.R.C. 71017
+McDowell, R.S. 70872
+McEachran, R.P. 71012
+McEvilly, T.V. 73730
McEwan, A.D. 71627
McEwan, A.D. 71628
+MacFall, J.R. 73963
MacFarlane, D.R.+ 72082
+MacFarlane, D.R. 71898
McGarr, A. 73775
+McGarr, N.S. 71311
+McGaughey, P.O. 70624
+McGill, T.C. 72865
Mach, R. 70625
+Mach, R. 73320
Macha, E. 70042
+Macherauch, E. 73129
+Machida, K. 70888
+Machiels, A.J. 72160
+Machlin, E.S. 71976
Machner, H.+ 70562
Machner, H.+ 70596
+Machner, H. 70606
Macho, V.+ 70092
+MacIsaac, D.G. 72089
+McIver, R.T., Jr. 70138
Mackay, T.L.+ 73174
McKean, D.C.+ 70877
McKean, D.C.+ 70876
McKee, S.+ 71523
+Mackenzie, J.D. 71895
+Mackenzie, M.W. 70876
+Mackenzie, M.W. 70877
McKenzie, S. 72102
McKenzie, S. 72120
McLaughlin, W.L. 70730
+McLean, R.G.D. 69920
+McLellan, A.G. 71175
McManus, J.+ 73849
McMechan, G.+ 73741
McMillan, P.+ 72791
McMillan, W.L. 71978
McNally, K.C. 73739
+McNaught, R. 74049
McNeil, J.A.+ 70549
+McNeil, J.A. 70550
+McOmie, J.F.W. 70846
McPherson, R. 72987
+McRae, D.S. 71510
McVey, L.A.+ 73385
Madey, R.+ 70601
Madey, R.+ 70600
+Madey, T.E. 72244
Madigosky, W.M.+ 71320
+Madix, R.J. 72222
+Madou, M.J. 72732
+Madura, J.D. 70982
+Madurga, G. 70524
+Madurga, V. 72597
+Maehara, I. 72809
Maekawa, S. 72557
+Maekawa, S. 72556
Maes, G. 70879
+Maestas, E. 70678
Magalhaes, J.+ 74027
Maggs, J.E.+ 71718
Magid, L.J.+ 73372
Magiera, A. 71085
Magiera, A.+ 71084
Magill, J.+ 72092
Magpantay, J.A. 70320
+Magri, L. 69981
Magrini, M.+ 73117
Magruder, R.H., III+ 72158
+Maguire, C.F. 70597
Maguire, G.Q., Jr.+ 73659
+Mahaffey, J.A. 73639
+Mahalanobis, R.K. 71386
Mahanthappa, K.T.+ 70264
Mahapatra, B.P. 70339
+Maharana, K. 70293
+Maharana, K. 70295
+Mahler, G. 72436
+Mahoney, J.F. 73024
+Mahrer, Y. 73906
+Mai, M. 72511
Maier, A.A. 71177
Maier, G. 69888
+Maier, J.P. 70937
+Maier, J.P. 70890
Maier, W.B. II+ 70894
Maillard, D.+ 70800
+Maillard, J. 70418
Maimistov, A.I.+ 71205
+Mainfray, G. 70831
+Maioli, M. 69906
+Maire, G. 72235
Maitani, F. 69860
Maiti, C.R. 72174
Maj, S. 73750
+Majdic, A. 73188
Majima, Y.+ 73621
+Majka, Z. 70615
Majumdar, S.Datta .... *see* Datta Majumdar, S.
+Majumder, D. 70779
Makarets, N.V.+ 71990
Makarov, A.A.+ 70845
Makarov, V.G.+ 73131
+Makarova, V.S. 69810
+Makaya, B. 72192
Makhankov, V.G.+ 72573
+Makhniov, A.-S. 70870
Maki, A.G.+ 70867
Maki, M.+ 73472
+Makin, V.S. 73255
+Makin, V.S. 72010
+Makino, Y. 72665
Maklakov, A.I.+ 72171
Maklakov, L.I.+ 71042
+Makoshi, K. 72919
+Maksimenko, Yu.N. 72441
+Maksimov, A.B. 70413
+Maksimov, L.A. 72600
+Maksimov, L.A. 72150
Malacara, D. 71076
Malakhov, B.A. 72513
Malathi, R.+ 73518
Malcor, J.G.+ 73113
Malfliet, R.+ 70569
+Malii, V.I. 71179
Malik, H.I. 73103
+Malik, N. 71835
Malinin, A.A. 71348
+Malinov, P.N. 71708
+Malinovskii, V.K. 72424
Malkan, M.A. 74169
+Malkin, V.M. 71717
Malmberg, J.H.+ 71700
+Malynovsky, E.I. 70413
+Malyshev, S.V. 72935
+Malyshev, V.I. 71208
+Malyutin, A.A. 71143
+Mamaev, A.V. 71071
+Mamantov, G. 73431
Mambo, M.+ 73947
Mambo, M.+ 73956
+Mamedov, K.S. 71575
+Maminov, O.V. 71554
Mamontov, A.P.+ 72016
+Mamontova, I.F. 73687
+Mamutov, V.S. 70049
Manchester, R.N.+ 74095
+Manchester, R.N. 74180
Mandal, K.+ 70936
+Mando', P.A. 70490
+Mandrioli, G. 70368
Mandula, J.E.+ 70209
Manenkov, A.A.+ 72012
Manes, L.+ 72075
Manevich, A.I. 71410
Mani, P.+ 73096
Manilla, J. 70132
Mank, V.V.+ 70902
+Manneville, P. 71964
+Manninen, M. 72204
+Manninen, M. 71984
+Manning, B. 74049
Manohar, H. 71838
+Manoharan, P.T. 72663
+Mansfield, G.R. 73629
+Mansingh, A. 72742
Manson, J.R.+ 72466
Mantell, C.L. 73429
Mantovani, E.+ 73748
Manu, C. 71464
+Manuel, J.R. 72179
+Manukyan, K.G. 73534
+Manunza, B. 72212
+Manus, C. 70831
+Manvelyan, O.S. 74009
+Manykin, E.A. 73689
+Manykin, E.A. 71205
Manz, J.+ 71037
Mao Nai-hsien . *see* Nai-hsien Mao
Mar, G.N.La .... *see* La Mar, G.N.
+Maran, S.P. 74123
Marcaillou, J.+ 70672
March, N.H. 70776
+Marchand, R. 71901
Marchenko, A.S.+ 73900
+Marchenko, R.I. 71989
Marchesin, D.+ 71600
Marchi, A.de . *see* de Marchi, A.
+Marchini, R.R. 69823
Marchuk, R.A.+ 71422
+Marciano, W.J. 70367
+Marcilhacy, G. 71697
Marconi, G. 70777
+Marcos, S. 70478
Marcus, P.S.+ 74065
Mareca, P.+ 70992
+Mareca, P. 70966
+Maret, G. 73523
Marevtseva, N.A. 71649
+Margalit, S. 71119
Margaritis, A.+ 73484
Margaritondo, G. 72487
+Margaritondo, G. 73371
+Margaritondo, G. 72965
+Margaritondo, G. 72251
+Margerie, J. 72772
+Margolese, D.I. 71993
Margolis, J.S. 73887
+Marholova, O. 73430
Maria, G.De .... *see* De Maria, G.
Mariani, C.+ 72234
+Mariani, C. 72777
+Mariani, F. 73965
Mariette, H.+ 72861
+Marikyan, G.G. 73550
Marin-Flores, J.L.+ 72837
+Marinchenko, A.V. 73333
Marino, E.C. 70170
+Marinov, K.D. 70413
+Marinov, M. 71888
+Marion, G. 72794
+Mariotti, S. 71901
Maripuu, R.+ 70951
+Maritan, A. 70009
+Mark, T.D. 71680
+Mark, T.D. 71025
Marko, H. 71081
+Marko, H. 71082
+Markov, P.K. 70413
Markovskii, E.A.+ 73220
+Markworth, A.J. 73199
Marmeggi, J.C. 71926
+Marmo, G. 70277
+Marmo, G. 69916
+Marmo, G. 69932
+Marnekov, O.S. 70163
+Marohnic, Z. 72637
Maroie, S.+ 72248
Marques, J.M.M.C.+ . 73104
Marr, G.V. 70164
Marreiros, M.S.+ 71339
Marris, A.W. 71562
Marris, A.W.+ 71521
Marron, M.T.+ 73630
Marsden, B.G. 74045
Marsden, B.G.+ 74047
+Marsden, B.G. 74053
+Marsden, B.G. 74052
+Marsden, B.G. 74044
+Marsden, B.G. 74051
+Marsh, J.T. 73583
+Marsh, K.A. 74058
Marsh, K.N.+ 71676
+Marshall, B.V. 73762
+Marshall, E. 70745
+Marshall, F.E. 74181
+Marshall, F.J. 74109
Marshall, H.L.+ 74172
Marshall, H.L.+ 74173
+Marshall, J.R. 74030
+Marshall, P.M. 71221
Marston, P.L.+ 71272
+Martelli, F. 72435
+Martellucci, A. 71594
+Martens, V.Ya. 70152
Martikainen, H.O.+ 71975
+Martin, B. 73864
Martin, D.H. 69842
+Martin, J.P. 70408
+Martin, P. 70607
Martin, P.C. 71558
+Martin, R.M. 73327
+Martin, S.A. 72917
Martin-Bertram, H.+ . 73646
+Martin-Brunetiere, F. 72772
Martinelli, G.+ 70221
+Martinez, G. 72866
+Martinez, R.M. 71743
Martinez, S.+ 69992
Martini, F.De .... *see* De Martini, F.
+Martinuzzi, S. 73439
Martirosov, S.M.+ 73548
+Marton, D. 72932
+Martschew, E. 70569
Martynenko, V.V.+ 73155
+Maruani, A. 72320
+Marullo, G. 70079
+Marumo, F. 71894
Maruyama, Y.+ 73644
+Maruyama, Y. 72855
+Marzari-Chiesa, A. .. 70368
+Marzec, S. 72876
+Marzocca, A.J. 72035
+Masalov, A.V. 71208
Masamune, S.+ 71797
Maschke, E.K.+ 71734
+Mashima, M. 73142
+Mashimo, S. 70085
+Mashkova, E.S. 72907
+Maslov, A.I. 71029
+Maslov, A.I. 73330
+Maslov, A.I. 73351
Mason, G.M.+ 74061
+Mason, K. 73588
+Mason, K.O. 74076
Masoud, M.S.+ 72388
Massa, W.+ 71934
+Massaad, S. 73464
Massabieaux, B.+ 71002
+Massai, M.M. 70752
Masters, A.J.+ 71606
+Mastushita, T. 73041
+Masuda, M. 70644
Masuda, S.+ 71834
+Masuda, Y. 72692
+Masumoto, T. 73150
Masur, L.J.+ 73094
Masychev, V.I.+ 71110
+Mataloni, P. 71141
Matecki, M.+ 71898
+Matecki, M. 72058
+Materikin, D.I. 72353
+Materlik, G. 72606
+Mathieu, H. 72317
+Mathis, R. 73242
+Mathisen, O.A. 71288
+Mathur, K.C. 71018
+Mathur, S.C. 72742
+Mathur, S.S. 73420
+Mathur, S.S. 71214
Mathur, V.K.+ 73466
Matkowsky, B.J.+ 69993
+Matsko, M.G. 72868
+Matsubara, E. 73091
Matsubara, F. 72583
+Matsubara, T. 73621
+Matsuda, H. 73128
Matsuda, T.+ 71216
+Matsui, Y. 71503
+Matsuki, T. 70262
Matsumoto, H.+ 73437
+Matsumoto, K. 72094
+Matsumoto, Y. 72945
+Matsunaga, K. 73480
+Matsuo, M. 73946
+Matsushita, K. 71080
+Matta, J.E. 71620
+Mattera, L. 72200
+Matteuzzi, C. 70399
+Matthews, J.L. 70543
Mattis, D.C. 72063
+Mattis, D.C. 72326
+Matveev, I.N. 71204
+Matveev, V.A. 70323
+Matveev, Yu.Ya. 71552
+Matveyeva, N.A. 73516
Matz, R.+ 72905
+Matzke, Hj. 73183
Mau Vinh .... *see* Vinh Mau
Maugin, G.A.+ 71607
Maurette, M.+ 73389
+Maurin, M. 71951
+Maury, S. 70408
Maxworthy, T. 71551
Maxworthy, T. 71581
May, M.+ 73302
+Maya, J. 71822
+Mayer, B. 74048
Mayer, D.A. 73823
Mayer, D.A.+ 73822
+Mayer, M. 71949
+Mayer-Boricke, C. 70562
+Mayer-Kuckuk, T. 70631
+Mazumdar, J. 71433
+Mazur, C. 70635
Mazur, P.O. 69953
+Mazzanti, P. 70368
+Mazzucato, E. 71729
+Meadowcroft, P.M. .. 73623
+Meadows, B.T. 70419
Meakin, P. 72285
+Meara, L.A. 73421
+Meazza, G. 73272
Mecham, W.J.+ 70703
+Mecham, W.J. 70702
Mecherikunnel, A.T.+ 73852
+Meczynska, H. 72337
Medley, J.H.+ 70901
+Medvedev, M.V. 72599
+Medvedev, Yu.P. 72400
+Meerschaut, A. 72379
+Mehlhorn, T.A. 70737
Mehmetoglu, M.T.+ ... 71809
+Mehrabadi, M.M. 71402
+Mehrabian, R. 72090
Mehrotra, K.N.+ 73377
Mehta, M.J.+ 70069
+Mei, F.M. 73474
Mei, W.N.+ 69913
+Mei, W.N. 70774
Mei-fang Yu .... *see* Yu Mei-fang

Meichle, M.+ 72107
Meier, R.J. 72577
+Meiron, D.I. 70209
Meirovitch, H. 70023
+Meisel, H. 73242
Meisel, L.V.+ 72373
Meisel, W.+ 73256
+Meissburger, J. 72917
+Meleshevich, K.A. 73066
+Meleshko, E. 72036
Meleshko, V.P.+ 73833
Meleshko, V.V. 71454
+Melkov, G.A. 72591
Mel'nik, B.A. 70162
+Mel'nikov, M.Ya. 72943
Mel'nikov, V.E.+ 70055
Mel'nikov, V.K. 69900
Mel'nikov, V.K.+ 72144
Melnikov, V.N.+ 74191
+Mel'nikov, V.N. 73382
+Mel'nikova, V.A. 72275
Melnitchenko, V.M.+ .71924
Meloni, F.+ 72307
Melville, W.K. 71583
+Menabde, M.G. 72656
Menchaca-Rocha, A.+ 70607
+Menchaca-Rocha, A. 70608
+Mendecki, A. 73725
Mendez, R. 71563
+Meneley, D.A. 70714
+Meng Jiangchen 70629
Meng-fen Xia .... *see* Xia Meng-fen
Meng-Shi Jin .... *see* Jin Meng-Shi
Menguc, M.P.+ 71341
+Menon, M.G.K. 73997
+Menyhard, M. 72282
Menzel, D.+ 72236
+Merceron, T. 72631
+Merdes, D.W. 70868
Merguerian, C. 73752
+Meriakri, S.V. 72647
+Meriani, S. 73059
+Merideth, C.W. 70862
Merkishin, G.V. 70032
Merkulov, I.A.+ 72709
Merkulov, I.A.+ 72711
+Merkulov, I.A. 72844
+Merle, J.C. 72807
Merle, J.-C.+ 72805
+Merlin, J.-C. 74043
+Merrill, R.T. 73941
+Mertens, R. 73449
+Mertens, R. 73444
+Mertens, R.P. 72414
Merwe, A.J.van der .... *see* van der Merwe, A.J.
Merwe, J.H.van der .... *see* van der Merwe, J.H.
+Mery, P. 70334
+Merz, F. 70443
+Mes, H. 71041
Meseguer, F.+ 72807
+Meservey, E. 71729
Meshalkin, Yu.P.+ 73527
Meshcheryakov, G.A.+ 74032
+Mesmer, R.E. 73359
+Messager, A. 72621
Messina, A. 72066
+Messina, A. 74174
+Messmer, R.P. 72540
+Mestre, L. 70530
+Mesyats, G.A. 71810
+Metcalf, M.G. 73100
Metiu, H. 72849
+Metselaar, R. 73111
+Mettes, J. 70979
+Mettwalli, N. 70554
Metz, P.D. 73481
+Metzger, J. 72286
Meulenberg, A.+ 73446
+Meyberg, W. 72151
Meyer, G. 70052
+Meyer, R. 71037
+Meyer, T. 71694
+Meyer, W. 72733
+Mezdrogina, M.M. 72700
+Mezentsev, A.N. 72427
Mezey, L.Z.+ 72210
+Mezhova, N.Ya. 73175
+Mezilev, K.A. 70507
+Mi Xin 71188
Micek, S.+ 70615
Michalske, T.A.+ 73273
+Michel, C. 72391
+Michel, C. 70587
+Michel, D. 72792
+Michelini, A. 70418
+Midlag, T. 72586
+Mielnicki, J. 72643
Miettinen, H.E. 70421
+Migalinskaya, L.N. .. 71634
+Mignerey, A.C. 70609
+Mignerey, A.C. 70608
+Migneron, R. 70349
+Miida, Y. 71278
+Mikaberidze, B.D. 72712
Mikami, A.+ 72870
+Mikami, T. 71216
Mikawa, H.+ 70652
+Mikawa, H. 72945
Mikes, T. 71088
Mikhailov, I.N.+ 70481
Mikhailovskii, A.B. 71767
Mikhailovskii, A.B.+ .. 71770
Mikhalenko, S.I.+ 73069
+Mikhaleva, T.N. 70525
+Mikhatulin, D.S. 71622
+Mikheenko, P.N. 72564
+Mikheenko, S.G. 74055
+Mikheev, L.D. 71114
+Mikhov, M. 72586
+Mikiel, W. 73304
+Mikityuk, B.V. 71217
+Mikityuk, O.Yu. 72328
Mikkelsen, J.C., Jr. 71998
+Mikluho, O.V. 70552
+Milanovic, V. 72486
Milbourn, S.W. 74040
Milbourn, S.W. 74041
Miles, J.W. 73830
+Miles, R.O. 71250
+Mileshkina, N.V. 72942
+Mileshkina, N.V. 72221
+Milet, B. 74046
+Milet, B. 74049
Mileti, D.S. 69855
Milewski, B. 70168
+Milewski, J. 71105
Milgram, A.+ 71986
+Milichevich, E.P. 72882
Millar, J.+ 73693
+Miller, D.A.B. 72769
+Miller, D.B. 70307
Miller, D.L.+ 71283
Miller, G.E. 74160
+Miller, J.M. 73868
+Millis, R. 74047
+Millman, P.M. 74052
Millner, A.R. 73453
Mills, G.+ 73290
Mills, J.S.+ 71053
Mills, P.+ 72947
+Mills, S. 70608
Millward, G.E. 73879
+Milosevic, S. 72568
Mil'shtein, A.I.+ 70300
Mil'shtein, S.+ 72448
Milton, K.A.+ 70312
Min Nam-Ki .... *see* Nam-Ki Min
+Minaev, A.A. 70698
+Minaev, V.K. 73175
Minahan, J.A.+ 73443
+Minakawa, K. 73223
Minami, S. 70330
+Minamiyama, T. 72173
Minard, R.A.+ 71175
Minato, T.+ 71040
Mindle, W.L.+ 71370
+Mine, Ph. 70418
Minet, R.G.+ 73485
+Minetti, B. 70584
Ming Rong Ji .... *see* Ji Ming Rong
Ming Zhao .... *see* Zhao Ming
Ming-yi Wang .... *see* Wang Ming-yi
Mingguang Li .... *see* Li Mingguang
Minh Tho Nguyen+ ... 73317
Minin, V.M. 73049
Mink, D.J. 74035
+Mintz, M.H. 73370
Mirels, H. 71112
+Mirjanic, D. 72312
+Mirjanic, D. 72542
Mirkin, M.A. 72213
+Mironova, N.A. 72853
+Mironova, N.A. 72854
+Miroshnichenko, F.D. 73133
+Mirovsky, Y. 73465
+Mise, T. 73142
+Misev, L. 70937
Mishima, Y. 70102
+Mishra, S.K. 71545
+Mishustin, I. 70611
+Misiewicz, J. 72766
Misra, A.+ 71494
Misra, S.P.+ 70338
Misra, S.P.+ 70294
+Mitchell, G.E. 72247
+Mitchell, G.E. 70528
Mitev, V.M.+ 73933
+Mitra, A.K. 71386
+Mitra, G.B. 71910
Mitra, P.+ 69940
+Mitra, S.S. 72838
+Mitra, S.S. 72261
Mitroshin, V.E.+ 70428
+Mitsunaga, Y. 71255
+Mittl, J.C. 70699
+Miura, I. 70593
Miura, N.+ 72306
+Miwa, K. 71116
Miyadai, T.+ 72582
Miyae, S.+ 73406
+Miyagawa, M. 72355
Miyagawa, S.+ 71991
+Miyagawa, Y. 71991
+Miyake, S. 73997
+Miyano, T. 72274
+Miyauchi, Y. 70644
Miyazaki, D.+ 71904
+Miyazaki, M. 71831
Miyazaki, T.+ 73064
+Miyazawa, T. 73054
Miyoshi, K.+ 73218
+Miyoshi, Y. 73621
+Mizeraczyk, J. 70835
+Mizoguchi, S. 73294
+Mizukami, K. 71371
Mizuno, E.+ 71393
+Mizuno, S. 73064
Mizusaki, J.+ 72387
Mizutani, T. 73510
+Mizutani, T. 72266
Mjolhus, E. 71719
Mladzhov, L.K. 72440
+Mobayyen, M.M. 70307
Mock, W., Jr.+ 73177
+Modesti, S. 72435
Moe, M.K.+ 70496
Moeller, T.+ 70897
+Moerl, L. 72780
+Mohammed, H.H. 70800
Mohan, P.+ 70643
+Mohan, R. 70643
+Mohanty, S. 70916
+Mohanty, U.C. 73804
Mohri, A.+ 71781
+Mohs, E. 73256
Moison, J.M.+ 72894
+Moker, M. 72423
+Molchanov, V.A. 72907
+Molinari, E. 70858
Molinari, R.L. 73829
+Moller, C. 71704
+Moller, R. 70972
Moloney, M.J. 69838
Monahan, E.C.+ 73880
+Monceau, P. 72379
+Mondal, N.K. 73997
Mondal, S.G. 71440
+Monduzzi, M. 70914
+Monerie, M. 71235
Mong Zao Ngueng .... *see* Ngueng Mong Zao
+Monnerie, L. 71907
+Montarou, G. 70753
+Montheillet, F. 73113
+Monticelli, C. 73250
Montmerle, T.+ 74182
+Montoya, S.M. 73812
+Montrose, C.J. 71508
+Montvay, I. 70302
+Mooberry, E.S. 70901
Moon Hee Kyong .... *see* Hee Kyong Moon
Moon Tak Jin .... *see* Tak Jin Moon
Moore, B.C.J.+ 71306
Moore, B.C.J.+ 73594
Moore, C.J. 73932
+Moore, G.R. 70910
+Moore, W.M. 73266
+Moorthy, L.R. 71115
+Mooser, E. 72307
+Morales, G.J. 71718
+Moran, K. 72990
+Morandi, G. 72620
Morante, J.R.+ 72497
+More, J.S. 71264
+More, K.M. 70922
Moreau, J.M.+ 72725
Morehead, F.+ 72151
+Morenza, J.L. 72497
Morenzoni, E.+ 71000
+Morgan, P.H. 72657
Morgan, W.L. 73969
Morgen, P.+ 73239
+Morgen, P. 72305
Morgovskii, L.Ya.+ 70163
+Morgun, V.N. 72375
+Mori, E. 71297
+Mori, H. 72659
+Mori, H. 69988
Mori, S.+ 71555
+Mori, T. 71977
+Mori, Y.H. 71658
+Morikawa, H. 71894
+Morimoto, A. 71078
Morimoto, T.+ 72800
+Morineau, R. 72397
+Morita, S. 73947
Moritani, A.+ 71228
Moritani, A.+ 71224
+Moriwaki, T. 73340
+Moriwaki, Y. 73487
Moriya, T. 70098
+Moriyama, N. 70661
+Morjean, M. 70635
+Morkoc, H. 72482
Morley, J.G. 73184
Morley, L.S.D. 71400
+Moroni, A. 70744
Moroz, Yu.F. 73718
+Morozov, A.N. 70413
Morozov, V.N.+ 71128
+Morozov, V.N. 71137
+Morozov, V.N. 71233
+Morozov, Yu.A. 72899
+Morozova, L.A. 73528
Morozova, V.A.+ 72771
+Morra, F. 73396
+Morris, A. 70945
+Morris, C.S. 74043
+Morris, C.S. 74052
+Morris, G.R. 70419
+Morris, M. 74126
Morris, P.J. 71618
+Morrison, D.R.O. 70307
+Morrison, G.C. 70445
+Morrisson, A.R. 70876
Morton, J.R.+ 72661
+Mosburg, E.R., Jr. 71824
+Mosca, L. 70368
+Moschetti, A. 73438
+Moscinski, J. 70715
+Moseenkov, Yu.B. 71458
+Moseley, J.T. 70865
Moseley, P.T.+ 71939
+Moser, P. 72884
+Moses, D. 70595
+Moses, T.H., Jr. 73762
+Moshchalkov, V.V. 72403
+Moshe, M. 70279
+Moskalenko, K.M. 70139
+Moskaleva, L.P. 74009
+Moskaleva, M.A. 72878
+Moskienko, M.V. 70855
+Moskvich, Yu.N. 72740
Moss, W.F. 71591
Mossakovs'kii, V.I.+ 71355
Mosser, A.+ 73243
+Mosser, A. 72126
+Mosser, A. 72193
+Mostafa, M.F. 72585
+Motaleva, N.V. 72504
+Motley, R. 71729
Motohashi, Y.+ 73143
+Motomiya, M. 73612
Motomizu, S.+ 73391
+Motsnyi, F.V. 72867
Mott, N. 69850
Motta, N.+ 72887
Mottola, E. 74196
Mottola, E.+ 74195
+Mouchaty, G. 70614
+Mouchaty, G. 70618
+Moucka, Z. 70750
Mouginis-Mark, P.J.+ 74022
+Mouginis-Mark, P.J. 74011
+Moulson, A.J. 73040
+Mouritsen, O.G. 70012
+Mourou, G.A. 71136
+Mourou, G.A. 71226
+Moussallam, B. 70404
+Movshon, J.A. 73580
+Moya, J.S. 72113
+Moynihan, C.T. 71889
+Moynihan, C.T. 72838
+Moynot, B. 74010
+Mozharovskaya, T.N. 73308
Mroczkowski, S.+ 72896
Mrowiec, K.+ 73030
Mroz, B.+ 72738
+Mroz, B. 72029
Mroz, J.+ 72857
+Mroz, M. 72762
+Mrygon, B. 72643
+Msezane, A.Z. 71019
Mucha, M.+ 72110
Muckett, S.J.+ 73280
+Muddle, B.C. 73089
+Mueller, A.C. 71030
Mueller, K.F.+ 73339
Mueller, P.+ 73566
Mugur-Schachter, M. .. 69910
Muhlhausen, C.W.+ ... 72913
+Muhonen, J. 70485
+Muir, H. 70136
+Mukai, Y. 72138
+Mukerji, N. 70350
+Mukhametkulov, M.A. 73029
+Mukhammedov, S. ... 72001
Mukhanov, V.F.+ 74197
+Mukherjee, A.K. 73168
+Mukherjee, N.G. 70762
Mukherjee, P.S.+ 71910
Mukhin, G.G.+ 73099
Mukhin, S.I. 72380
+Mukhin, V.A. 71569
+Mukhopadhyay, K. 73457
+Mukunda, N. 70277
+Mukunda, N. 69932
Mulak, G. 71090
Mulford, R.A.+ 73264
+Mulheron, M. 72140
+Mulheron, M. 72141
Muller, B.+ 71047
+Muller, C. 73927
Muller, F.+ 70887
+Muller, G.O. 72836
+Muller, H. 73889
Muller, H.G.+ 70828
+Muller, K. 72205
+Muller, N. 73465
Muller, P. 71388
+Muller, W. 73298
+Muller, W.F.J. 70594
+Muller, W.F.J. 70576
+Muller, W.F.J. 70587
Mumladze, A.I.+ 71554
Munch, R.+ 72606
Mundt, R.+ 74067
Mungall, A.G.+ 70040
Munn, R.W. 72362
+Munn, R.W. 71851
Munnix, S.+ 72465
+Munz, D. 71474
+Munzel, H. 72168
+Munzenberg, G. 70641
+Mura, T. 71357
+Mura, T. 71468
+Murai, S. 73621
+Murakami, T. 73960
+Murakami, T. 70618
Muranoi, T.+ 72263
+Murase, K. 72426
+Murata, Y. 72949
Murayama, K.+ 71962
+Murayama, Y. 73179
Murday, J.S.+ 72371
+Murdin, P. 74128
+Muret, P. 72493
+Murmann, H. 71749
Murphy, C. 70044
Murphy, C.J.+ 73561
+Murphy, J.K. 73999
Murray, J.E. 71130
+Murray, R.T. 71221
Murthy, A.S.N.+ 73331
Murthy, G.S. 73709
Murthy, G.S. 73710
Murthy, K.N.Venkatasiva .... *see* Venkatasiva Murthy, K.N.
+Murthy, K.P.N. 69986
Murthy, M.V.N.+ 70379
+Murthy, M.V.V. 71498
+Murzenko, V.V. 71641
+Musa, H. 70975
Musatov, A.L.+ 72940
Muschietti, L.+ 71728
+Musikhin, A.M. 73027
+Musso, A. 70584
Mustafin, N.V.+ 73838
+Muto, K. 69995
+Muto, Y. 72558
Muttalib, K.A. 72358
Myakotin, E.A. 73210
Myasnikova, T.P.+ 71876
+Myatt, G. 70307
+Mycielski, W. 72523
+Mydlarz, T. 72578
+Myklebost, K. 70368
+Myoung-Ho Lee 73551
Myska, J.+ 71648
+Mysyrowicz, A. 72862
Mytsyk, B.G.+ 72768

Naaman, A.E. 69884
+Nabitovich, I.D. 72218
Nadkarni, G.S.+ 72516
Nadtochii, A.A. 73299
+Nadutov, V.M. 72716
+Nadworny, M.M. 69893
+Naeser, C.W. 73934
+Nagafuchi, T. 73125
+Nagahisa, T. 73686
+Nagamoto, C. 73871
+Nagano, I. 73947
+Nagano, I. 73956
+Nagarajan, M.A. 70522
+Nagarajan, M.A. 70619
+Nagasaka, H. 72446
+Nagata, S. 70474
+Nagata, Y. 70921
Nagayoshi, H. 72468
+Nagin, V.Ya. 71326
Nagle, D.E. 70271
+Nagy, A.F. 74038
+Nai-hsien Mao 73501
Nai-Qiang Wu .... *see* Wu Nai-Qiang
+Naidu, M.S. 71826
+Naidu, P.R. 72048
+Naidu, P.R. 72023
Nair, K.R.+ 72393

+Nair, S. 71465
+Naito, S. 70080
Nakabushi, H.+ 70147
Nakagawa, Y. 70114
+Nakai, J. 71224
+Nakai, J. 71228
+Nakajima, O. 72508
Nakajima, T.+ 73886
+Nakamura, A. 70229
+Nakamura, A. 70343
+Nakamura, A. 70078
Nakamura, M.+ 73202
+Nakamura, N. 72274
+Nakamura, N. 70915
+Nakamura, Y. 73960
+Nakamura, Y. 72276
+Nakamura, Y. 73084
Nakane, H.+ 70089
+Nakano, A. 73437
+Nakano, C. 72095
+Nakano, O. 73128
Nakashima, H.+ 73607
+Nakashima, H. 72949
+Nakata, R. 72669
+Nakatani, H. 71834
Nakatsuji, H. 70788
+Nakatsuji, H. 70920
Nakayama, A.+ 71526
+Nakayama, K. 73649
+Nakayama, M. 72329
Nakayama, S. 70824
+Nakoryakov, V.E. 71569
+Nakra, B.C. 71299
Naletova, V.A. 71659
+Nalivaiko, A.A. 71074
+Nam-Ki Min 72514
+Namba, S. 72329
+Namboodiri, M.N. 70618
Namikawa, T.+ 71721
Nan Xue Zen .... *see* Xue Zen Nan
Nanbu, K. 71574
Nandi, R.N.+ 70853
Nanopoulos, D.V.+ 70278
+Nanopoulos, D.V. 70378
+Napolitano, C. 69981
+Nappi, A. 70368
Napravnik, J.+ 70668
+Napravnik, J. 70653
+Naquet, R. 73697
+Naranan, S. 74096
+Narasimham, V.S. 73997
+Narasimhan, T.N. 73847
Narayan, R. 73283
Narayan, R.+ 74097
+Narayan, R. 71921
+Narayanan, G.V. 71353
+Nardon, G. 74001
+Narihara, K. 71781
Narison, S.+ 70331
+Nasby, R.D. 73448
+Nassir, A. 71299
+Nassisi, V. 71108
+Natarajan, S. 72049
+Nather, H. 72436
+Natowitz, J.B. 70618
Natrajan, N.S. 70026
Natsume, Y.+ 72660
Naughton, M.D.+ 70729
+Naukkarinen, K. 72014
Naumenko, E.K.+ 71073
+Naumov, V.S. 72009
+Naumov, Yu.V. 70484
Navard, P.+ 71867
+Navarro, R. 72133
Naviroj, S.+ 71034
Navneet+ 70133
+Nayar, B.K. 71248
Nayfeh, A.H. 69866
+Naylor, D.A. 74125
Nazarathy, M.+ 71195
Nazarathy, M.+ 71196
Nazarenko, S.N+ 73403
+Nazarov, G.B. 72221
+Nazarov, Yu.G. 72817
+Nazmeev, Yu.G. 71554
+Neal, N. 73443
+Neal, W.W. 70405
Nebbia, G.+ 70635
+Nebbia, G. 70744
Nechipurenko, Yu.D. 73509
Nechitailo, V.S. 72011
+Nechitailo, V.S. 72012
Nedelina, O.S.+ 73543
+Nedyukha, I.M. 73220
Ne'eman, Y. 70251
+Negi, O.P.S. 70179
+Nellen, B. 70307
+Nelson, A.H. 70442
+Nelson, J.E. 69941
+Nelson, J.M. 70563
Nelson, M.E.+ 70399
+Nelson, R.O. 70528
+Nelson, W.R. 70752
+Nemashkalo, B.A. 70428
+Nemat-Nasser, S. 71469
Nemchinov, I.V. 71601
+Nemecek, S. 70413
Nemes, L.+ 70870
Nemes, M.C.+ 70527
+Nemets, O.F. 70553
+Nemoshkalenko, V.V. 73105
+Nemoto, K. 73785
+Nenashev, V.A. 73533
Nepiiko, S.A.+ 72900
+Nesbitt, D.M. 73396
Neskakis, A.+ 70432
+Nessi, M. 71000
+Nesterov, M.M. 70633
+Nesterova, S.N. 71958
Neta, B.+ 70022
+Netterfield, R.P. 70104
+Netusil, T. 70750
Netzer, F.P.+ 72244
+Neubert, W. 70633
+Neufeld, P. 73014
+Neukum, G. 74024
Neumann, B.+ 70606
+Neumann, L. 70653
+Neumann, M. 72233
+Neunhoeffer, H. 70946
+Nevin, J.H. 72996
+Newberry, N.G. 73788
+Newell, J.C. 73678
+Newell, W.R. 71023
+Newland, D.B. 71827
Newlove, S.A. 72570
+Newman, J. 72458
Newman, K.E.+ 72752
+Newman, K.E. 72464
+Newns, D.M. 72919
+Newton, L.M. 74095
+Ng, C.Y. 70961
+Ng, J.N. 70384
Ngee-Pong Chang+ 70292
+Ngo, C. 70612
+Ngo, C. 70635
+Ngueng Mong Zao 70413
+Nguyen, K. 71620
+Nguyen Hong Shon 72455
Nguyen Minh Tho .. *see* Minh Tho Nguyen
+Ni Hui-lin 71460
+Ni Yu-yun 71129
Nian-Zu Wu .... *see* Wu Nian-Zu
+Niarchos, D. 72636
+Nicholson, P.S. 73189
Nick, K.-P.+ 70817
+Nickel, B. 70933
Nickel, H.+ 70688
+Nickerson, E. 73871
+Nickerson, J. 73265
Nicklin, R.C. 69818
Nicklin, R.C.+ 69821
Nicodemo, L.+ 72032
+Nicolais, L. 73438
+Nicolais, L. 72032
+Nicolais, L. 73237
+Nicolescu, B. 70417
+Nicolosi, P. 71796
Nied, H.F.+ 71482
+Niedermeyer, H. 71749
Nield, D.A. 71642
+Nielsen, H.B. 70247
Nielsen, O.V. 72598
Nielson, O.V.+ 72597
+Niemann, U. 73360
+Niemax, K. 70801
+Niemi, A. 70171
+Niesen, L. 72720
+Niesen, L. 72721
Nieuwenhuizen, P.van .... *see* van Nieuwenhuizen, P.
Nieuwenhuys, B.E. 73369
+Nieuwland, H.C.D. 70689
Nieuwstadt, F.T.M. *(ed.)* 69793
Niewiadomski, J. 73726
+Niewiadomski, J. 73926
+Nihoul, G. 71974
Niihara, K. 72038
+Niiler, P.P. 73814
Nijhoff, F.W.+ 69861
+Nijs, J.F. 72414
Nikaien, K.+ 71261
Nikam, R.S.+ 70253
Nikias, C.L.+ 73938
Nikishov, V.I.+ 71588
+Nikitchenko, Yu.A. 71650
+Nikitin, P.I. 71758
+Nikitin, V.V. 72478
+Nikobadze, G.I. 70413
Nikolaev, S.N.+ 70332
+Nikolaev, V.A. 70557
+Nikolaevsky, V.N. 73806
+Nikolenko, N.G. 73162
Nikolopoulos, P.+ 72386
+Nikolov, A.V. 70361
Nikolov, N.A.+ 71708
Nikomarov, E.S. 72096
+Nikonov, B.P. 72460
Nikulin, D.A.+ 71546
Nikulin, N.K.+ 71650
+Nikulin, V.N. 70552
+Nikulin, Yu.A. 72352
+Nikulin, Yu.N. 71924
Nilles, H.P. 69961
Nilles, H.P.+ 69964
+Nilsson, J.S. 70277
+Nilsson, J.S. 69932
+Nimatov, S.Zh. 72215
Ning Hu .... *see* Hu Ning
Ning-hai Hu .... *see* Hu Ning-hai
Nishibayashi, S.+ 73192
+Nishigaki, M. 72084
+Nishihara, H. 71797
+Nishihara, M. 72527
+Nishijima, M. 72231
Nishikawa, K.+ 70782
+Nishikawa, S. 73002
Nishimori, H. 72622
Nishimura, M.+ 71062
+Nishioka, K. 71837
+Nishiura, H. 70504
Nishizawa, T.+ 73061
Nisht, M.I.+ 71602
Nitsolov, S.L. 70123
+Nitsolov, S.L. 73933
+Nitsovich, V.V. 72328
Nitzan, A.+ 72225
+Nitzan, A. 72784
Niukkanen, A.W.+ 70771
+Nivellini, G.D. 70765
Nix, W.D.+ 73146
+Niyogi, K. 70509
+Nizegorodcew, P. 70715
+Noack, D. 70696
+Noakes, D.R. 72636
Nobili, D.+ 72119
+Nobl, C. 72959
+Nobuhara, S. 71727
Nockolds, C.E.+ 72990
+Noda, F. 72660
Noda, N. 71385
+Nogues, M. 72956
+Noilhan, J. 73855
+Nolan, P.J. 70442
+Noll, H. 70587
+Nolt, I. 73871
+Nolting, H.P. 71225
+Nomachi, S.G. 71296
+Nomine, J.C. 70677
+Nomine, J.C. 70672
+Noonan, J.R. 72198
+Norbert, A. 71951
+Nording, C. 70823
Nordlander, P. 72924
+Norenberg, W. 70599
Norin, A.V. 71792
+Noring, J.E. 73410
Normantas, E.+ 72423
+Norris, C. 72958
+Norskov, J.K. 72918
Northrup, C.J.+ 70687
Northwood, D.O.+ 73176
Norton, R. 71791
+Noskin, V.A. 73687
Noskova, N.I.+ 73219
+Notin, M. 71892
Nour, E.M.+ 70863
Novaes, S.F. 70420
+Novak, M. 70413
+Novakov, T. 73920
+Novakova, D. 70541
+Novello, M. 71789
Novikov, I.D. 69809
+Novikov, V.A. 70031
Novikov, V.P.+ 70120
Novikov, V.P.+ 70121
+Novikov, Yu.N. 70507
+Novotny, R.W. 70597
+Novskova, T.A. 73633
+Nowak, H. 70413
Nowak, J. 71093
Nowak, J.+ 71091
Nowik, I.+ 73507
+Nowotny, H. 73223
+Noz, M.E. 73659
+Nozaki, R. 70085
+Nozaki, T. 72840
Nozieres, P. 72315
+Numao, T. 70371
+Nurmikko, A.V. 72832
+Nurmukhamedov, A.M. 70507
Nuss, M.+ 70895
Nuttall, A.H. 71307
+Nuttall, A.L. 73591
+Nyborg, W.L. 71283

Oakley, C.+ 70261
Oba, R.+ 71617
Oba, R.+ 71616
+Obata, N. 73292
+Oberacker, V.E. 70463
+Oberacker, V.E. 70637
Obert, T.+ 72360
+Oblozinsky, P. 70482
+Obodovs'kii, L.V. 71437
+Obolonchik, V.A. 72760
O'Brien, D.M.+ 71502
+O'Brien, H.A., Jr. 73664
+O'Brien, S.J. 73755
+Obukhov, S.P. 72629
+Obukhov, V.I. 70055
+Obuki, S. 70089
Ochando, M.A.+ 72196
Ochiai, A.+ 70665
+Ochkas, L.F. 73057
O'Connell, R.J. *(ed.)* 69784
+O'Connell, R.W. 74162
Oda, T.+ 71689
+O'Dell, C.R. 74130
Odell, J.A.+ 71868
+O'Driscoll, C.F. 73755
+Odstrcil, M. 73482
Oechsner, H.+ 72926
+Oehlinger, G. 71940
+Oelert, W. 72917
Oelfke, W.C. 69970
Oertzen, W.von .... *see* von Oertzen, W.
+Oeschler, H. 70592
+Oeschler, H. 70603
+Ofengenden, R.G. 70553
+Ofer, S. 73507
+O'Gallagher, J. 73424
+Ogata, H. 70593
+Ogata, N. 73194
Ogawa, T. 69851
Ogden, T.E. 73568
Ogleznev, K.Ya.+ 73584
+Ogorodnikov, V.K. 72420
+Ogorodnikov, V.K. 72269
+Ogurtsov, S.V. 72277
+Oh, B.Y. 70405
+O'Handley, R.C. 72091
+Ohba, Y. 71116
Ohbayashi, K.+ 69998
+Oheda, H. 72355
Ohga, M.+ 69885
Ohgushi, K. 73595
+Ohira, T. 73214
+Ohji, K. 72770
+Ohsawa, Y. 71743
+Ohse, R.W. 72137
+Ohse, R.W. 72092
Ohshima, T.+ 71296
Ohta, K.+ 70920
+Ohta, M. 73125
Ohta, N.+ 70935
+Ohtaka, K. 72788
+Ohtsuka, K. 70665
+Ohuchi, F. 72255
+Oi, T. 72162
Oinas, V. 73914
Oishi, Y.+ 72157
+Ojha, I.D. 70589
+Ok Hee Chung 72676
Oka, T. 70377
+Oka, T. 71698
Okabe, S. 70529
+Okabe, S. 70444
Okada, K.+ 73142
Okada, K.+ 73125
Okada, S.+ 72980
+Okada, T. 73226
Okajima, K.+ 72027
Okajima, K.+ 72127
Okal, E.A.+ 73742
Okamoto, H.+ 72659
+Okamoto, H. 69988
+Okawa, M. 70223
+Okazaki, S. 73340
+Okazaki, T. 70374
+O'Keefe, M.A. 71981
+Okinaka, H. 73054
Okland, H. 73856
Okopinska, A. 70268
+Oktik, S. 73004
+Okubo, S. 70374
Okubo, T.+ 73619
+Okuda, Y. 71224
+Okuno, M. 71894
Okushi, H.+ 72355
+Olaniyi, B. 70371
+Oldham, D.J. 71304
+Olefir, V.P. 71737
+Oleinik, T.V. 71073
Olesen, J.F. 71364
+Olesen, P. 70364
+Oleszkiewicz, J. 72304
+Olevskaya, S.M. 73892
Olhoff, N.+ 71438
Olimpiev, S.L.+ 72813
+Olin, A. 70371
+Olins, G.M. 73691
+Oliva, A. 73314
+Olivain, J. 71800
Olive, D.+ 70169
+Olive, K.A. 70278
Oliveira, F.A. 72652
+Oliver, J.E. 73768
+Ollila, K. 70701
+Olmi, A. 70576
+Olmi, A. 70612
Olmo, M.A.del .... *see* del Olmo, M.A.
+Olson, C.G. 72831
+Olson, C.G. 72833
+Olson, J.M. 73005
+Olsson, G. 70802
+Olsson, L.G. 70989
+Olsson, N.A. 71120
+Olsson, T. 70797
+Olsson, T. 70802
+Omarov, S.Z. 74002
+Omel'chenko, A.Ya. 71770
Omenyi, S.N.+ 73545
+Omizzolo, A. 74001
+Omori, S. 70089
Omote, M.+ 70222
+Onaka, R. 72827
Onaka-Ito, T.+ 72855
Onate, E.+ 71374
Onate, E.+ 71375
+Onchi, M. 72231
Ondoh, T.+ 73960
+Ondracek, G. 72386
Onishchenko, E.E. 71484
+Onishchenko, I.N. 70732
+Ono, T. 71977
Onoda, G.Y., Jr. 73044
+Onopyuk, S. 72036
Onuki, Y.+ 72559
op de Beeck, J.+ 70741
+Opanasenko, N.V. 74002
Opdorp, C.van .... *see* van Opdorp, C.
Oppen, G.von .... *see* von Oppen, G.
Oppenheim, H. 73034
Orange, G.+ 73207
Orasanu, M.T. 71645
+Orbach, R. 72370
Orders, P.J.+ 72964
+Oreshenkov, A.I. 70049
Orient, O.J.+ 70987
Orihara, H.+ 72789
+Oritz, M. 69886
+Orlik, Z.K. 72763
+Orlikowski, T. 70991
+Orlov, R.Yu. 71070
+Orlov, S.V. 74191
Orlov, V.K.+ 73029
Orlova, I.G.+ 73048
+Orlova, N.V. 70530
Orr, T. 70073
+Orsini, N.A. 73930
Orszag, S.A.+ 71652
+Orszag, S.A. 70209
Orudzhaliev, E.A. 70712
+Orzechowski, J.A. 71524
+Osadchii, S.M. 72758
+Osaka, A. 71890
Osaka, T.+ 73006
+Osawa, M. 73262
Osborne, A.R.+ 73831
+Osendi, M.I. 72113
O'Shea, M.J.+ 72607
Osherov, V.I.+ 69915
+Osip'yan, Yu.A. 72425
+Oskarsson, A. 70611
Ossner, E. 71504
+Ostapenko, V.N. 72906
Ostdiek, V.J.+ 69843
Osten, W.von der .... *see* von der Osten, W.
Ostrander, L.E.+ 73678
Ostro, S.J.+ 74033
+Ostroborodova, V.V. 72771
+Ostrovskaya, G.V. 70128
Ostrovskii, A.A. 73158
Ostrovskii, L.A.+ 71626
+Ostrovskii, Yu.I. 70128
+Ostry, D.J. 73698
+Otrok, A.I. 73027
+Otsuka, T. 70593
Ott, H.R.+ 72533
+Otto, A. 72961
Ottonello, P.+ 71213
+Otubo, Y. 73619
Ou-Yang Ting .... *see* Ting Ou-Yang
+Ouillon, R. 70860
+Ouwens, C.D. 72998
Ouyang Zi-yuan 74056
Ovadyahu, Z.+ 72522
+Over, H.H. 70688
+Overhof, H. 72363
Overstraeten, R.Van . *see* Van Overstraeten, R.
+Ovryn, B. 72522
Ovsyuk, V.N. 72382
Owen, D.R.J.+ 71330
+Owen, D.R.J. 73104
+Owen, L. 71253
+Owens, E.O. 73691
+Ower, H. 70441
+Oxenius, J. 70818
+Oxenius, J. 70819
+Oye, H.A. 72143
Oza, B.N. 70061

Ozaki, H.+ 72509
Ozaki, S.+ 71830
Ozawa, S.+ 71046
Ozeretskovskii, B.V. 71043
+Ozernoy, L.M. 74157

+Paal, A. 70143
Paal, Z.+ 72938
Paccanoni, F. 70310
Pacchioni, G. 70793
+Pacchioni, G. 71045
Pacesova, S.+ 72753
Pacilio, N.+ 69981
Paczynski, B.+ 74073
Paddock, N.L.+ 71953
+Padgett, R.A. 73198
+Padiou, J. 71928
+Padmore, H.A. 72958
Paek Yong-Hyun *see* Yong-Hyun Paek
+Paes-Leme, P.J. 71600
+Pagana, E. 73995
+Page, L. 73791
+Page, P. 73797
Pagels, H.R. 69957
+Pai, D.M. 72447
+Paik, J.S. 72079
+Paikham, L.M. 73627
+Painter, H.A. 72116
Pajot, B.+ 72842
+Pakhomov, E.E. 72485
+Pakhomov, E.E. 73240
+Pakvasa, S. 70416
+Pakvasa, S. 70380
Pal, K.F.+ 70456
+Pal, K.F. 70522
+Palamarchuk, V.I. 72483
+Palangie, E. 72691
+Palanisamy, P.K. 72049
+Palaniswamy, N. 73284
Pal'chevskii, A.S.+ 71419
Palgen, L.+ 71398
+Palmer, B.A. 70816
+Palmer, P. 74039
+Palmer, R.L. 72920
Palmer, W.F.+ 70375
Palmour, H., III+ 73022
+Palombarini, G. 73272
+Paloski, W.H. 73678
Palosz, B. 71937
Palumbo, A.C.+ 72602
+Palumbo, F. 70446
+Pambukhchyan, N.Kh. 72003
Pan Da-ren+ 71027
Pan Fu-Shih *see* Fu-Shih Pan
+Pan Shao-hua 72297
+Pan Shun-chen 71064
Pan-ming Fu *see* Fu Pan-ming
Panchanathan, V.+ 73032
+Panchenko, Yu.N. 70870
Pandey, P.C.+ 73919
+Pandit, J. 73519
+Pandit, R. 72252
Pandita, P.N.+ 70256
+Pandya, J.M. 73285
Pankova, M.N.+ 73135
+Pankrath, J. *(ed.)* 69792
+Pankratov, I.M. 71750
+Panofsky, H.A. 73860
+Panosyan, G.A. 70125
+Panova, Ya.I. 72728
+Pant, M.C. 73491
+Pantelides, S.T. 72860
Panteliou, S.+ 71331
+Panyukov, S.V. 72565
+Panzarino, J.N. 73629
Panzer, S.+ 72017
+Papanicolaou, G.C. 71586
+Paparazzo, E. 72956
Papatheodorou, G.N. 70847
+Pape, L. 70307
+Papineau, A. 70753
+Papon, P. 73376
+Papousek, D. 70854
Papp, F.F.+ 70754
+Pappalardo, G. 70436
+Pappalardo, L. 70096
+Parak, F. 73520
+Paramonov, Yu.M. 72139
Paranjape, M.B.+ 70255
Parashar, R.S.+ 72372
Parashar, R.S.+ 73190
Pardo, L.+ 73314
+Pare, C. 71193
+Pare, C. 71207
+Parfenov, A.V. 72869
+Parfenova, N.S. 73687
+Parga, N. 70363
+Parida, B.K. 70338
+Paritskii, L.G. 70128
+Parizet, M.J. 70753
+Park, J.Y. 70574
+Park, R.L. 72903
+Park, Y.K. 71962
+Park, Y.S. 71994
Parker, A.P.+ 71478
+Parkin, M. 70618
+Parks, R.D. 72602
+Parks, R.L. 70561
+Parlinski, K. 72097
+Parphenuk, O. 73772
Parrinello, M.+ 72104
+Parthasarathy, M. 74068
+Parthasarathy, R. 70287
+Partridge, I.K. 72124
Parungo, F.+ 73871
Pascual, C.+ 72156
Pasechnik, V.I. 73536
+Pashaev, O.K. 72573
Pashchenko, A.V. 71715
+Pashkov, V.A. 72009
+Passerone, A. 72182
Passoja, A.+ 70488
+Passynkov, V.V. 72728
Pastushenko, V.F.+ 73537
Patel, B. 71139
Patel, B. 71140
Patel, R.B.+ 73285
+Patera, A.T. 71652
+Patkos, A. 70213
+Paton, A. 72203
+Paton, J. 70311
+Patrick, J.F. 70399
+Patterson, C.C. 73875
+Patterson, J. 74071
Patterson, R.J., II 73023
Paulin, J.Saint Jean *see* Saint Jean Paulin, J.
Paulson, R.R.+ 73203
Paunovic, M.+ 73007
+Paunovic, M. 73010
Pautzke, A.W. 73427
Pauw, P.De. *see* De Pauw, P.
+Pavel, J. 71871
Pavelescu, C.+ 72786
Pavelets, S.Yu.+ 72491
+Paver, N. 70331
+Pavithran, C. 73062
+Pavlik, V. 69864
+Pavlov, V.A. 73219
Pavlovic, M.+ 73405
+Pawel, H.E. 71654
Pawlikowski, M. 70880
+Payne, G.L. 70551
+Payne, J.M. 73994
+Payne, L.E. 69881
+Payne, M.G. 70941
+Pazzi, R. 70368
+Peacor, D.R. 73788
+Pearsall, T.P. 72950
+Pearsall, T.P. 71118
+Pearson, L. 73010
+Pearson, R., Jr. 73874
+Pearson, T.D.L. 70936
+Pearson, T.J. 74176
+Pech, R. 70307
+Pechenezhskii, V.I. 72177
+Pecheur, P. 72342
+Pedanov, V.V. 72015
+Peddieson, J., Jr. 71261
+Pedlar, A. 74093
+Pedley, T.A. 73608
+Pedrazzi, E. 70415
+Peeva, A.T. 70746
+Pegg, D.T. 70926
Peggs, G.N.+ 73311
+Peghaire, A. 70635
Pegushina, G.A.+ 71971
+Pehler, T.O. 71172
Pei Cheng-Chih *see* Cheng-Chih Pei
Pei-zhen Zhou *see* Zhou Pei-zhen
Peiwen Lin *see* Lin Peiwen
Peiyou Xue *see* Xue Peiyou
Pekar, S.I.+ 72756
Pekker, L.S. 71772
Pelikh, L.N. 72103
Peliti, L.+ 72228
Pellerin, F.+ 72895
Pelletier, J.B.+ 73246
Pellett, G.L.+ 73494
+Pelous, J. 72822
+Pelous, J. 72821
+Pelous, J. 72062
Pelte, D.+ 70742
Peltier, W.R. 73781
Peltonen, E.+ 70684
+Pelz, J. 72437
+Pemsing, K. 71390
+Pena, R. 70766
+Pender, R. 71550
+Pendrill, L.R. 70797
Pendrys, L.A.+ 72561
+Peneva, I.Kh. 71737
+Peng, J.C. 70438
+Peng Zheng-Yu 71870
+Peng-fei Liu 73392
+Penisson, J.M. 71965
+Penka, V. 72237
+Penkalla, H.-J. 70688
Penzkofer, A.+ 71155
+Pepper, M. 72398
+Perazzo, R.P.J. 70439
+Percus, J.K. 69990
Percus, O.E.+ 69990
Percy, J.R. 74080
Percy, K.E. 73497
Perel, J.+ 73024
+Perel, V.I. 72844
+Perel', V.I. 72418
Perepezko, J.H.+ 72079
+Perez-Leclaire, H. 73784
+Perez-Mendez, V. 70752
+Perfetti, P. 73371
Peridier, C.A.+ 70543
+Perk, J.H.H. 72569
+Perl, M.L. 70399
+Perlin, S.M. 73131
+Perlmutter, A.L. 73575
Permyakov, Ye.A.+ 73528
+Perreau, J. 72927
+Perrone, M.R. 71108
Perrot, J.P.+ 70896
+Perry, A.M. 74063
Perschmann, W.-D.+ 71033
Person, W.B.+ 70838
+Person, W.B. 70956
Person, W.B. *(ed.)* 69802
+Personick, S.D. 70728
+Peruzzi, R. 72356
+Peschov, V.D. 70750
+Peshev, V.V. 72016
+Pesses, M.E. 74060
Peters, M. 73115
+Peters, N. 71664
+Petersen, J.L. 70364
Peterson, B.+ 71442
+Peterson, C. 70352
+Peterson, J. 73930
Peterson, N.L. 72170
+Peterson, N.L. 72161
+Peterson, Y. 73599
+Pethick, C. 70611
+Pethrick, R.A. 72024
+Petitjean, C. 70631
+Petkov, I.Zh. 70557
+Petnikova, V.M. 71204
+Petrashen', V.E. 72668
+Petrides, A. 70307
+Petro, L.D. 74104
+Petropavlovskaya, M.S. 73850
+Petropoulos, J.H. 72229
+Petropoulos, J.H. 72230
+Petrosyan, L.S. 73548
Petrov, B.F.+ 70484
+Petrov, V.A. 70057
+Petrov, V.K. 70324
+Petrova, A.D. 71795
+Petrova-Maslakova, L.G. 73687
Petrovic, J.J. 73293
+Petrovici, M. 70576
+Pettersson, K. 73599
+Pettinger, B. 72780
+Petushkov, V.A. 71405
+Petzel, T. 72977
Pevtsov, A.B.+ 72327
+Peyerimhoff, S.D. 70784
+Peyerimhoff, S.D. 70785
Peyghambarian, N.+ 72862
+Pfeffer, R. 71637
Pfeifer, P.+ 69938
+Pfendt, F. 71354
+Pfeufer, V. 70803
Pfingst, B.E.+ 73589
+Pfnur, H. 72236
+Pfoh, A. 70575
+Pham Van Vui 73458
Phan, T.Hieu *see* Hieu Phan, T.
Phan-Thien, N. 71568
Phatak, S.C.+ 70520
+Philip, J. 72055
+Philipetsky, N.F. 71071
+Philippot, E. 71951
+Phillips, A. 72990
+Phillips, M.S. 73598
+Phillips, R.J. 74006
+Phillips, R.L. 73396
+Phipps, C.R., Jr. 71199
Phoenix, S.L.+ 73095
+Phua, K.K. 70410
+Pi, M. 70477
+Piancastelli, M.N. 70952
Pianetta, P.+ 70734
+Piccitto, G. 72294
+Pich, B.O. 70449
+Piche, M. 71193
+Picoli, G. 72866
+Pielke, R.A. 73906
+Pierazzini, G.M. 70368
Pierre, T.+ 71725
+Pietnev, V.A. 71233
+Pietrzak, J. 72696
+Pifer, A.E. 70409
Pilarski, A. 71280
Pilbrow, J.R.+ 72666
Pilkington, J. 70028
+Pillai, P.K.C. 70133
Pillai, S.O.+ 72049
+Pillet, P. 70827
Pilot, C. 69962
+Pilpel, N. 73154
Pilyankevich, A.N.+ 72275
Pilyankevich, A.N.+ 72906
+Pindzola, M.S. 70761
Pinsky, P.M.+ 69886
+Pinsky, S.S. 70375
Piotrowska-Szczepaniak, J. 72384
+Pipa, V.J. 72756
+Pipkin, F.M. 70795
+Piriou, B. 71893
+Piriou, B. 72791
+Pirogov, A.N. 71929
+Piskarskas, A.P.C. 70958
Pitea, D. 73318
Pitowsky, I. 69974
+Pitt, G.D. 71247
+Pivac, B. 73414
Pivin, J.-C. 72916
+Pivot, J. 73464
Piza, A.F.R.de Toledo *see* de Toledo Piza, A.F.R.
+Plachendovskii, D.I. 70064
+Plagnol, E. 70598
Plain, A.+ 71798
+Plain, A. 71002
+Planeta, R. 70606
Platzer, H.+ 71082
+Platzer, N. 70918
+Plaut, R.H. 71438
Plavsic, D.+ 71045
+Pleitez, V. 70244
Plescia, J.B.+ 74013
+Pletcher, R.H. 71541
+Pletscher, A. 73695
+Plichta, M.R. 73043
Plindov, G.I.+ 70756
+Pliner, L.A. 73800
+Plinski, E.F. 71166
+Plishkin, Yu.M. 72169
+Plishkin, Yu.M. 71956
+Pliva, J. 70868
Plonka, A. 73352
+Plotnichenko, V.G. 71110
+Plurien, P. 70707
+Pluta, M. 71084
+Plytnikas, A. 72409
+Poate, J.M. 72081
+Poate, J.M. 72992
+Pochtman, Yu.M. 71355
+Podchernyaeva, I.A. 73028
+Podchinenov, I.E. 72169
+Podchinenov, I.E. 71956
Podgorny, M.+ 72304
Podgorny, V.I. 72936
+Podgornykh, S.M. 72617
+Podlivayev, I.F. 73800
Podor, B. 72345
+Poe, R.T. 70585
Poelsema, B.+ 72920
+Pogorelov, V.E. 72815
+Pogorel'skii, I.V. 71114
+Pogrebnya, S.K. 70756
Poirier, A.+ 72850
+Poite, J.C. 70783
+Poitou, J. 70753
+Poitou, J. 70612
+Pokhotelov, O.A. 73958
Pokorny, Z. 73707
Pokrovskii, O.M.+ 73894
Polak, M.+ 73370
+Polak, R. 70980
+Polakos, P.A. 70409
Poland, J.+ 73336
Polezzo, S.+ 73332
+Polikanov, S. 70631
+Pollacco, E. 70598
+Pollack, J.B. 74030
Polonskii, Yu.A.+ 73047
+Polovkov, A.F. 71602
+Poluektov, I.A. 72869
+Poluyanov, L.V. 69915
+Polyakov, A.S. 70680
Polyakov, A.V.+ 73951
Polyakov, S.P. 71806
Polyakov, S.V.+ 73959
+Polyakova, V.P. 73219
Polyanskii, V.K.+ 71095
Pomeau, Y.+ 71964
Pomeroy, P.W.+ 73730
Pomortsev, R.V.+ 72427
+Ponec, V. 72201
+Ponezha, G.V. 71179
+Ponezha, O.O. 71179
Ponomareva, T.I.+ 72139
Pons, J.N.+ 72834
+Pons, R. 71697
+Pontecorvo, G.B. 70751
+Pontoppidan, S. 70620
+Poon, E. 72416
+Pope, D.P. 73147
Pope, J.M.+ 70704
+Pope, S. 72154
+Popkov, A.N. 72401
+Popov, A.I. 72680
+Popov, A.L. 71421
+Popov, A.M. 71820
+Popov, A.P. 72600
Popov, E.V.+ 70140
Popov, V.I.+ 70429
+Popov, V.P. 72273
+Popov, V.P. 72986
+Popov, Yu.M. 72869
Popovic, Z.V. 72783
+Popovkin, B.A. 72739
+Poppa, H. 72249
+Popryadukin, A.P. 71769
+Popytalov, S.A. 71602
+Porowski, S. 72348
Porter, A.J.+ 71846
Portnoi, V.I.+ 72033
+Porubcan, V. 74054
+Posbic, J. 73464
+Pose, A.V. 70413
+Possiel, N. 73864
Post, H.N.+ 73451
Post, R.F. 71777
Post, R.F. 71786
+Potapenko, E.S. 72489
+Potekhin, A.G. 70751
+Potel, M. 72658
+Potember, R.S. 71172
+Potempa, A. 70507
Pottier, P.+ 70678
+Pottier, P. 70677
+Poucher, J.S. 70394
+Pougheon, F. 70445
+Poulain, M. 72838
+Poulain, M. 71898
Poulsen, C.+ 70883
Poulsen, F.R.+ 73530
+Poutissou, J.-M. 70371
Povolo, F.+ 72035
+Powell, B.M. 72795
Powell, J.D.+ 71804
Powers, J.E.+ 73695
Pozdnyakov, A.V.+ 70523
+Poznyak, E.L. 71455
+Prabhavalkar, P.D. 70984
+Prakash, M. 70586
Prakash, T.L.+ 73204
+Pranal, Y. 70635
+Prance, R.J. 70088
+Prantera, V. 72776
Prasad, K.A.Durga *see* Durga Prasad, K.A.
Prasad, S.D.+ 73363
Prasad, S.V.+ 73062
+Prasova, T.I. 72632
+Pratap, M. 70405
+Pratt, N. 70864
+Pratt, R.H. 71247
+Predko, K.G. 71168
+Preece, A.W. 73546
+Prekul, A.F. 71930
Preskill, J.+ 70200
+Press, W.H. 74065
Prest, H.F.+ 70961
Preston, D.+ 70272
+Preston, D. 70246
+Preston, K.F. 72661
+Prestwich, W.V. 70491
+Prete, G. 70744
+Preti, G.P. 73655
Prewitt, C.T.+ 71936
+Price, B. 73741
+Priestley, C. 73290
+Prieur, J.-Y. 72059
+Priezzhev, V.B. 71044
+Prigge, D. 72938
+Prigodin, V.N. 72532
+Primus, I.-F. 73468
Prince, A.+ 72080
Priori, A.+ 73237
+Privalko, V.P. 73162
+Procaccia, I. 71512
Prochazka, I.+ 70485
+Proctor, M.R.E. 73720
+Proctor, M.R.E. 73721
+Prokes, A. 70413
Prokhnitskii, L.A. 72826
Prokhorenko, A.S.+ 71210
+Prokhorov, A.M. 71735
+Prokhorov, A.M. 71759
+Prokhorovich, A.V. 72421
+Prokof'ev, A.L. 73306
+Prokof'ev, O.E. 70552
+Prokof'ev, P.T. 70486
+Prokof'eva, E.A. 72185
Prokof'eva, L.V.+ 72352
+Prokofiev, A.N. 70542
+Prokopenko, V.T. 70105
Prokop'ev, V.I. 71408
+Pronin, I.I. 72901
+Pronina, N.A. 72935
+Pronko, P.P. 71987
+Pronko, P.P. 71994
+Pronko, P.P. 72272
+Pronko, P.P. 71992
Prosch, T.+ 73923
+Proshutinskii, A.Yu. 73838

+Prosser, F.W. 70638
+Protic, D. 70596
Protopopescu, V.+ 69894
+Provenzale, A. 73831
Provost, J.R.+ 72614
Prozorkevich, A.V.+ 70232
Prud'homme, R.E. 72125
+Prudnikova, G.V. 72939
Pruess, K.+ 73847
Pruett, C.H. 70735
+Pruger, Kh.I. 70141
Prussin, S.+ 71993
+Przedmojski, J. 72109
+Psarev, V.A. 74002
+Pucci, R. 72294
Puchelle, E.+ 73620
+Puchkovskaya, G.A. 72277
+Pudkov, S.D. 73255
+Pudkov, S.D. 72010
Puel, F. 73974
+Pugh, E.N., Jr. 73566
+Pulatova, S. 72194
+Pullia, A. 70383
+Pullia, A. 70499
Pundir, R.S.+ 71018
Pundur, P.A.+ 72874
+Pura, B. 72109
+Puri, R.R. 70808
+Puritis, T.Ya. 72433
+Purkis, A. 69826
Pustovalov, V.N.+ 71552
+Putilin, Yu.M. 70057
Putkovich, K. 70038
+Pyka, M. 71884

Qadir, A. 70024
+Qi Shang-xue 73434
Qian-feng Wu+ 73392
Qin-xi Xie ...... *see* Xie Qin-xi
Qing-lan Zhao ...... *see* Zhao Qing-lan
Qing-lian Zhou ...... *see* Zhou Qing-lian
Qingshi Zhu ...... *see* Zhu Qingshi
+Quagliano, L.G. 72435
Quebert, J.L.+ 70602
+Queijeiro, A. 70391
+Quemeneur, A. 71800
+Quenzel, H. 73889
+Querrou, M. 70408
Quesada, J.M.+ 70524
Quick, W.H.+ 71242
+Quigley, R. 74106
Quillec, M.+ 72521
+Quinlan, K.P. 72264
Quinn, D.+ 73270
+Quinn, J.J. 72083
Quinn, P.C.+ 73579
Quinn, W.E. 71780
+Quinn, W.E. 71787
+Quintenz, J.P. 70737
+Quiroga, L. 72694
+Quispel, G.R.W. 69861

Rabalais, J.W. 72915
+Raber, E. 73934
+Rabinovici, E. 70175
+Rabinovici, E. 70210
Rabinowicz, M.+ 73757
+Rabitz, H. 70976
+Rabitz, H. 73313
Rabl, A.+ 73411
+Rabolt, J.F. 72820
+Racca, C. 70753
+Raccah, P.M. 72752
+Rach, R. 69858
+Raciti, G. 70436
+Raczka, R. 70218
+Radavich, J.F. 73079
+Radelaar, S. 72998
+Radhakrishnan, T.S. 70068
+Radhakrishnan, V. 74097
+Radharkrishnan, S. 72516
Radic, S.M. 72973
+Radick, R.R. 74106
+Radovic, S. 73405
+Radyushkin, A.V. 70332
+Rae, J. 70651
Rafaniello, W.+ 73043
+Rafelski, J. 70316
+Rafert, B. 69821
+Rafferty, M.P. 71317
+Rafie, S. 73617
Raghunathan, S.+ 71531
Raghurama, G.+ 71921
Raghuraman, K.+ 70632
+Raghuvanshi, G.S. 72796
Ragiadakos, C.+ 70198
+Ragosta, J.A. 73186
+Rahal, G. 70418
+Rahimullah, K. 70805
+Rahman, A. 72104
+Rahman, A. 72031
+Rahman, N.K. 70965
Rai, A.K.+ 71992
+Rai, A.K. 71994
+Rai, A.K. 72272
+Rai-Choudhury, P. 73454
+Raimondi, M. 73332
+Rainey, V.S. 71939
Raj Kanwar..*see* Kanwar Raj
+Rajaraman, R. 70005
+Rajasekaran, G. 70296
+Rajasekaran, G. 70297
+Rajasekaran, G. 70422
+Rajasekaran, G. 70308
+Rajasekaran, G. 70401
+Rajasekaran, G. 70402
Rajewska, A.+ 72109
Rajput, B.S. 69958
+Rajput, B.S. 70179
+Rajput, B.S. 70240
+Rajput, B.S. 70326
+Raju, K.K. 71413
Raju, K.Kanaka ..*see* Kanaka Raju, K.
+Rakhimov, A.T. 71820
+Ral'chenko, V.G. 73335
Raleigh, B. 73737
+Ram, J. 71855
+Ram, P.N. 72175
+Ram Babu, P. 70305
+Ram Babu, P. 70306
Ramaiah, K.Subba ...... *see* Subba Ramaiah, K.
Ramakrishna, B.L.+ 72663
+Ramakrishnan, K. 73163
Ramakrishnan, P.+ 70528
Raman, R.V. 73035
Ramani, K.+ 70981
+Ramani, K. 70984
Ramaniah, K.Venkata ...... *see* Venkata Ramaniah, K.
+Ramasastry, C. 72667
Ramberg, S.E. 71559
+Ramm, E.J. 70681
+Ramous, E. 73117
Rampling, M.W.+ 73613
Rana, G.La. *see* La Rana, G.
+Ranachowski, J. 73304
Randa, J. 70265
+Randa, J. 70264
Randjbar-Daemi, S.+ 70206
Randjbar-Daemi, S.+ 70207
Range, H.D. 73571
+Rannikko, S.J. 73665
+Rao, A.D. 73804
+Rao, A.K. 71498
+Rao, C.N.R. 72782
Rao, D.N.+ 72048
Rao, E.S.Bhagiradha ...... *see* Bhagiradha Rao, E.S.
Rao, G.Venkateswara ...... *see* Venkateswara Rao, G.
Rao, G.Venkatewasara ...... *see* Venkatewasara Rao, G.
Rao, K.R.+ 73642
Rao, K.Singa..*see* Singa Rao, K.
+Rao, K.V. 72606
Rao, P.Veerabhadra ...... *see* Veerabhadra Rao, P.
+Rao, T.V.R. 70839
+Rapoport, V.O. 73959
+Rapp, M. 73116
+Rappaport, S. 74104
Raptis, A. 71543
+Raptunovich, G.S. 71344
+Raschke, E. 73923
Rasizade, O.Sh. 70231
+Rasmussen, J.L. 71007
+Raspet, R. 71301
+Rassokhin, V.A. 71930
Ratajczyk, F. 70097
Ratajczyk, F. 70103
+Ratliff, S.T. 71743
+Rauch, H. 70738
+Rauch, V. 70575
+Raudino, A. 70760
Raue, R.+ 72948
+Rauhala, E. 72014
+Rav-Noy, Z. 71119
+Raveau, B. 72391
Ravikovich, A.I. 73213
+Rawlings, R.D. 73234
Ray, L.+ 70447
+Ray, M.A. 72752
+Ray, M.K.S. 70669
Ray, P.R.+ 70762
Raychaudhuri, A.K.+ 74102
Raychaudhuri, A.K.+ 72046
Rayner, D.M.+ 73354
Raynor, G.V.+ 73067
+Razumovskii, P.N. 73634
+Razzaq Ismail, A. 73227
+Rebel, H. 70615
+Rebel, H. 70606
Recasens, D. 71313
Reddy, B.G.Krishna ...... *see* Krishna Reddy, B.G.
Reddy, K.Subramanyam .. *see* Subramanyam Reddy, K.
Reddy, R.R.+ 70839
Redfield, A.C.+ 72464
+Redkobordoyi, Yu.N. 73236
Redlich, W.+ 72977
+Reed, J.S. 73037
+Reedy, G.T. 70702
Reedy, R.E.+ 71985
+Rees, D. 71134
Reeve, K.D.+ 70681
Reeves, A. 73574
+Reeves, J.H. 70497
+Rehak, P. 70419
+Reher, E.-O. 71556
+Rehm, R.G. 71333
+Rehme, H. 72484
+Rehwald, W. 73668
Reich, S. 69839
+Reich, S.L. 70439
+Reicha, F.M. 72278
+Reichelt, E. 73153
Reichert, J.F. 69820
+Reichle, H.G., Jr. 73945
+Reid, R. 73290
Reiffenrath, V.+ 71866
+Reihl, R.F. 72258
+Reiman, S.I. 72718
+Reimringer, B. 70690
+Reineck, I. 70951
Reinecke, T.L.+ 72322
Reinhard, R. 73966
+Reinhardt, J. 71047
+Reinhart, F.K. 71225
+Reisdorf, W. 70641
+Reisler, H. 70962
+Reist, H.W. 70631
+Rekalo, A.P. 70395
Rekalo, M.P.+ 70395
+Rembeza, S.I. 72353
+Remizov, A.V. 71356
+Rempe, N.G. 72970
+Ren Jun-guo 71427
+Renard, M. 72379
+Renfer, D.S. 72447
+Renn, J. 70185
+Renner, R.H. 73339
+Rentzepis, P.M. 73531
+Renz, G. 71163
Requena, A.+ 70766
+Restuccia, A. 70197
+Rettig, S.J. 71953
Reuter, W.+ 70489
+Revesz, P. 71997
Revin, O.G.+ 72422
Reya, E. 70400
+Reymann, D. 70077
Reynaud, C.+ 72835
Reynaud, C.+ 72202
+Reynolds, A.H. 73531
Reynolds, D.D.+ 70054
Reynolds, R.J. 74124
Reznik, A.I.+ 72473
+Rheme, C. 69825
Rhoades-Brown, M.J.+ 70637
Rhoades-Brown, M.J.+ 70463
+Rhoades-Brown, M.J. 70620
+Rhyne, J.J. 72616
+Rhyner, C.R. 69823
+Riazi, A. 71180
+Ribrag, M. 70635
+Ricard, A. 71823
+Ricard, A. 71002
+Ricard, A. 71798
+Riccati, L. 70368
+Ricci, R.A. 70744
+Rice, S.A. 70997
+Rice, S.A. 70998
+Rice, S.L. 73223
+Richard, J.M. 70347
Richards, J. 71147
Richards, J.+ 71134
+Richardson, M.C. 71763
Richardson, N.V. 72960
+Richardson, S.L. 72203
+Richman, M.R. 73164
+Richmond, J.C. 73852
+Richter, A. 70572
+Richter, B. 70399
Richter, W.+ 72553
+Ricks, R.A. 71846
+Ridha, A. 70945
+Ridley, T. 70975
Rieder, K.H.+ 72204
+Rieder, K.H. 72199
+Riedinger, L.L. 70441
+Rieke, G.H. 74098
+Riepe, G. 70596
Rikovska, J.+ 70541
+Rimbert, J.N. 73638
+Rinaldi, D. 70928
+Rindani, S.D. 70296
+Rindani, S.D. 70297
+Rindani, S.D. 70422
+Rindani, S.D. 70308
+Rindani, S.D. 70401
+Rindani, S.D. 70402
Ringdal, F.+ 73733
+Rinkleff, R.-H. 70813
+Riordan, E.M. 70394
+Rioux, F. 69831
+Risbud, S.H. 73058
+Ristovski, L.M. 72312
+Ritchie, G.L.D. 72764
+Ritchie, G.L.D. 72765
+Ritchie, R.O. 73277
+Ritsko, J.J. 72331
+Ritter, H.G. 70517
+Ritz, A. 72905
+Ritz, Ch.P. 71696
+Rivet, M.F. 70592
+Rivet, M.F. 70603
+Rivet, M.F. 70578
Rivkind, V.Ya.+ 71615
+Rivlin, A.A. 70141
Rivlin, L.A.+ 71127
Rivlin, R.S.+ 73173
+Rivlin, V.G. 73067
+Rizkallah, P.J. 72394
+Robb, M.A. 70985
+Robert, J.L. 72348
Robert, W.+ 73590
+Roberts, B.L. 70543
+Robertson, J.G. 74177
Robinson, H.G.+ 70036
+Robinson, I.A. 70075
+Robinson, P.J. 73656
Robinson, R.L.+ 70597
+Robinson, R.L. 70608
+Rocca, M. 72200
+Roche, G.R. 70608
+Rode, G.G. 71035
Roden, G.I.+ 73820
Rodionov, A.N.+ 72284
+Rodrigues, D.C.S. 72662
+Rodriguez, L.F. 74127
+Rodriguez-Mijangos, R. 72837
+Roekaerts, D. 69930
Rogachev, A.V.+ 72262
Rogachev, K.A. 73901
Rogde, S.A.+ 71857
+Roger, J. 72834
Roger, J.A.+ 73464
+Rogers, G.W. 69927
+Rogers, H.P.D. 71676
Rogers, J.A.+ 73552
+Rogers, R.L. 71836
+Rogge, M. 72917
Rohatgi, A.+ 73454
+Rohatgi, P.K. 73221
+Rohatgi, P.K. 73062
+Rohrer, H. 72197
+Roitsin, A.B. 70094
Rokhlin, S.I. 71321
+Rokugo, K. 73191
+Rolla, G. 73611
+Rolnick, W.B. 70424
+Roman, O.V. 73031
+Romanek, K.M. 72436
Romanov, O.V.+ 72504
+Romanov, V.P. 72757
Romanova, G.F.+ 71989
+Romanova, M.M. 74100
+Romanovskii, V.N. 70671
+Romanowski, T. 73493
+Romanyuk, N.A. 72768
+Romanyuk, N.I. 70754
+Romelt, J. 71037
+Romer, J.G.M. 72917
+Romero, A. 70368
+Romestain, P. 70660
Ronen, Y.+ 70709
Rong Ji Ming ...... *see* Ji Ming Rong
+Ronge, K. 70451
+Ronningen, R.M. 70441
Ronzyova, B.de ...... *see* de Ronzyova, B.
Roo, M.de..... *see* de Roo, M.
+Roos, B. 70763
Roos, E. 70646
+Root, R.R. 71048
+Rooth, C.G.H. 73827
+Roper, L.D. 69816
+Ropke, G. 70570
Rorden, R.J.+ 70149
+Rosa, R. 71339
Rosales, R.+ 71586
+Rosanov, O.V. 72740
+Rosch, W. 70587
+Roschger, E. 71100
+Rose, J.H. 72339
+Rosei, R. 72777
+Rosen, A. 70802
Rosen, G. 70254
Rosen, H.+ 73920
Rosen, S.P. 70493
+Rosenblatt, D.H. 72953
+Rosenblatt, D.H. 72966
Rosenbluth, M.N.+ 71731
Rosenfeld, R.N.+ 73355
+Rosenfield, A.R. 73199
+Rosensteel, G. 70434
+Rosenthal, A.J. 74070
+Rosezin, H.-J. 70694
+Rosicky, F. 71014
+Rosner, G. 70638
Rosny, G.de ...... *see* de Rosny, G.
+Ross, G.G. 70261
Ross, P.N., Jr. 73433
+Ross, R.G., Jr. 73452
+Rosseneu, M.Y. 73529
+Rossi, A.M. 70368
Rossmanith, H.P. 71481
Rosso, O.A.+ 70505
Rostoker, N.+ 71775
+Roth, H.-K. 73347
+Rottigni, G.A. 71213
+Rouch, J. 71096
Rouet, A. 70211
+Rouff, M. 72178
+Rouse, J.W., Jr. 73939
+Rousseau, J. 73697
Roussel, F.+ 70963
+Roussel, P. 70445
Routbort, J.L.+ 73183
+Rouvrais, B. 73674
+Rouxel, J. 72379
Rovithis, P.+ 74114
+Rovithis-Livaniou, H. 74114
+Rovner, G. 69987
Rowe, E.M. 70736
Rowe, J.E.+ 72950
+Rowlinson, J.S. 72183
+Rowson, P.C. 70399
Roy, A.+ 71273
+Roy, A.E. 73975
+Roy, D.P. 70416
Roy, S.R.+ 74189
+Roynette, J.C. 70598
+Rozaj-Brvar, A. 72989
+Rozenberg, B.A. 72139
+Rozhkov, V.M. 72703
+Rozman, S.I. 72028
+Rozumnyi, V.D. 72269
Ruan Tu-nan+ 69937
Ruban, V.A. 69948
+Rubashevskii, A.A. 73068
+Rubezhanskii, Iu.I. 71349
+Rubin, A.B. 73508
Rubinov, A.N.+ 71187
+Rubinstein, R. 70409
+Rudecki, P. 70825
+Rudenko, B.A. 70553
+Rudenko, N.V. 72473
+Rudiger, J. 70484
+Rudigier, H. 72533
Rudnick, L.+ 74168
Rudnitskii, L.A. 72472
+Rudolph, W. 71151
+Rudraiah, N. 73760
+Rudzei, G.F. 73307
+Ruegg, K.J. 72724
+Ruette, F. 70780
+Rugar, D. 71318
+Ruhl, F. 71807
Ruivo, M.C.+ 70473
+Ruiz, E. 72188
Ruiz-Lopez, M.F.+ 70928
+Ruiz-Mejia, C. 72837
Rumi, D.S.+ 72215
+Rumpf, E. 73646
Rumpf, H.G.+ 73217
Rumyantsev, V.V.+ 72899
Runde, B. 73297
+Runolfsson, O. 70418
+Runow, P. 70693
Runt, J.+ 72799
+Ruppel, H. 73514
Ruppersberg, H.+ 71839
+Ruppersberg, H. 71865
Ruppin, R. 71050
+Rusakov, S.V. 70413
+Rusakov, V.V. 71614
+Ruscev, M. 70457
Ruscic, B.+ 70949
+Rushbrooke, J.G. 70405
+Rushton, A.M. 71041
Russell, G.J.+ 73004
Russell, P.E.+ 72452
Rutenberg, A.+ 71368
+Rutherford, P.H. 71731
Rutkowsky, J.+ 73320
+Ruuskanen, A. 70683
Ruvo, A.De. *see* De Ruvo, A.
Ruyven, L.J.van ...... *see* van Ruyven, L.J.
Ryabchenko, S.M. 72715
Ryabchenko, V.A. 73834
+Ryabushkin, D.S. 72655
+Ryasny, G.K. 72718
+Ryazantsev, Yu.S. 71638

+Rybin, V.V. 71973
+Rycerz, Z. 70715
Rykalin, N.N.+ 71160
+Ryl-Nardzewska, H. 73304
Rymden, R.+ 72747
+Rysavy, M. 70833
+Ryseck, H.-E. 70413
Rysiakiewcz-Pasek, E. 72823
+Rytel, L. 70263
+Rytova, N.S. 72401
+Rytter, E. 72143
+Rzepka, E. 72772
+Rzhavin, A.F. 73527

+Saad, E.S. 71072
+Saadalah, F.A. 73106
+Saari, P. 70124
+Saayman, R. 70454
+Saba, G. 70914
+Sabbagh, J. 71013
Sabersky, R.H. 69848
+Sabina, F.J. 71273
+Sabio, M.L. 70790
Sabir, M.+ 70235
+Sabirov, S.T. 72219
Saburi, Y. 70027
+Sachenko, A.V. 72503
+Sadaev, B. 72478
Sadek, E.A. 71366
+Sadikov, I.P. 71903
+Sadof'ev, Yu.G. 72488
+Sadof'ev, Yu.G. 72848
+Safarov, Yu.S. 71389
Safin, A.G.+ 70048
+Safin, V.A. 70091
+Safonov, A.N. 73236
+Safran, G. 72282
Safronov, A.N. 70461
+Safronov, A.N. 70508
+Sagatov, Ya.R. 72220
+Sagawa, T. 72499
+Sage, K.A. 70492
+Sagitov, S.I. 72869
+Saha, H. 73457
+Saha, S. 70509
+Saha, S.K. 72223
+Sahasrabudhe, G.G. 70253
+Sahm, C.C. 70641
+Sahto, M.A. 73206
+Saichev, A.I. 71075
Sa'id, W.K.+ 71299
+Saidov, A.S. 72478
Saidov, M.S.+ 72478
+Saint Jean Paulin, J. 72192
Saint Simon, M.de .... *see* de Saint Simon, M.
Saint-Andre, B.De .... *see* De Saint-Andre, B.
+Saint-Lager, M.C. 72379
Saito, S.+ 70851
+Saito, Y. 73368
Saitoh, M. 72675
Saitsev, A.M.+ 70053
+Saitta, D. 70307
+Sakai, H. 70591
+Sakai, K. 70000
Sakai, O.+ 72556
Sakai, T. 73050
+Sakakibara, Y. 72508
+Sakakura, Y. 73621
+Sakao, H. 72027
+Sakao, H. 72127
+Sakharova, N.B. 73403
+Sakka, S. 72582
Sakuma, S.+ 71297
+Sakuraba, I. 70129
+Sakurai, K. 73925
+Sakurai, T. 70147
Sakuyama, H.+ 70423
Sala, G.+ 73459
+Salaev, E.Yu. 72872
+Salam, A. 70206
+Salam, A. 70207
+Salama, K. 73201
Salanon, B.+ 72927
+Saleem, M. 70411
+Salem, T.M. 72388
+Salgado, J. 70966
+Salganik, G.Z. 70048
Salih Yaseen, R.+ 73227
+Salimov, O.N. 74055
+Salisbury, D. 70185
+Salivar, G.C. 73170
+Sal'nikov, V.A. 71623
+Salpekar, S.A. 71968
+Salpeter, E.E. 74186
+Salusti, E. 73832
Salvago, G.+ 73260
Salvago, G.+ 73261
+Samarin, V.K. 73127
+Sambogna, G. 73272
+Samgina, O.N. 73220
+Samoilik, A.V. 70081
Samoilov, S.N.E. 74089
Samokhvalov, A.A.+ 70101
+Samorodov, V.L. 70232
Samouel, M.+ 73074
+Sampoli, M. 71900
+Samskog, P.-O. 72673
+Samson, P.C. 73694
+Samsonenko, N.V. 70501
Samsonov, O.I. 73489
+Samsonova, M.B. 72459
San Ho Tak .... *see* Tak San Ho
+Sanchez, A. 72196
Sanchez, C.+ 72397
+Sanchez, J.P. 72612
Sanctuary, B.C. 72685
Sandberg, J.V.+ 70740
Sandberg, V.D. 69949
Sande, J.B.Vander .... *see* Vander Sande, J.B.
+Sander, G. 71352
Sander, L.M. 72309
Sanders, C.L.+ 73639
+Sanders, W.T. 74184
Sanderson, N.E.+ 70563
+Sandner, W. 70153
Sandroff, C.J.+ 70923
+Sandstrom, D.R. 71891
Sang Don Choi+ 72676
Sankar, T.S.+ 71480
+Sankarraman, N. 72516
+Sann, H. 70612
+Sannikov, Yu.A. 71419
Sano, M.+ 73686
+Sanochkin, Yu.V. 71747
+Sansonetti, P. 71235
Santangelo, E.M. 70393
Santi, D.+ 71796
Santignon, P.de .... *see* de Santignon, P.
+Santo, R. 70621
+Santo, R. 70594
+Santoro, A.F.S. 70415
Santos, M.P.Dos .... *see* Dos Santos, M.P.
Sapriel, J.+ 72208
+Saraceno, M. 70439
+Saramito, B. 71734
Sarantakos, S.+ 70367
Sarazin, C.L.+ 74162
+Sarazin, C.L. 74134
Sarazin, D.+ 72026
+Sargent, A. 74129
+Sargent, C.P. 70449
Saripalli, K.R. 71667
+Sarkar, U. 70294
Sarlet, W. 69869
+Sarma, C.R. 70253
+Sarma, K.R. 73455
Sarma, K.Venkateswara .... *see* Venkateswara Sarma, K.
+Sarma, K.V.L. 70379
Sarma, V.N.+ 70804
Sarmiento, J.L.+ 73827
+Sarracino, A. 70383
+Sarracino, A. 70499
+Sartori, G. 70257
+Sasabe, S. 71328
+Sasagawa, F. 72660
+Sasai, M. 72289
+Sasakawa, E. 73686
+Sasaki, A. 72527
+Sasaki, K. 73948
+Sasaki, M. 71604
+Sasamoto, T. 72387
+Sasamoto, T. 72094
+Sass, J.H. 73762
+Sass, J.K. 72242
+Sasse, E. 72253
Sasselow, D.D. 74082
Sata, T.+ 72094
Sataric, M.+ 72369
+Sato, K. 70950
+Sato, K. 72830
Sato, M.+ 72544
Sato, M.+ 71239
Sato, N.+ 73166
Sato, S.+ 73195
Sato, S.+ 73194
Sato, S.+ 73193
+Sato, S. 71403
+Sato, S. 73166
+Satoh, K. 71727
+Sattarov, M.G. 70406
Sauchyn, D.J.+ 73795
+Sauer, M. 70898
+Sauer, R. 72319
+Saunders, I.J. 72383
Saunders, K.D.+ 73944
+Saunders, R.S. 74006
+Saunders, R.S. 74013
+Saunier, N. 70436
+Sauniere, J. 71662
Sauter, A.+ 70647
Sauvajol, J.L.+ 71882
+Sauvajol, J.L. 72794
Savich, M.L.+ 73627
Savich, P.+ 73398
+Savinell, R.F. 71686
+Savinskii, S.S. 72674
+Savitskii, E.M. 72051
+Savitskii, E.M. 73219
+Savoie, R. 70859
+Savushkin, L.N. 70523
+Savyak, V.V. 72429
+Sawada, Y. 70665
+Sawant, B.M. 70922
Sawayanagi, H.+ 70374
+Saxe, P. 70789
+Saxena, M.C. 72730
Saxton, P.M.+ 73692
Sayasov, Yu.S.+ 71696
Sazhin, S.S. 71741
+Sazonov, S.G. 72504
Sbitnev, V.I. 73554
+Scaife, C.W.J. 70058
Scalapino, D.J.+ 70002
+Scarpetta, G. 69916
+Schaad, L.J. 70836
+Schaad, T. 70399
Schaber, G.G. 74019
+Schachinger, E. 71063
+Schad, L. 70575
+Schadel, O. 73217
Schaefer, B.E.+ 74071
+Schaefer, H.F., III 70789
+Schaefer, J. 71682
Schaefer, R.J.+ 72090
+Schafer, H. 71948
+Schafer, W. 72321
Schaich, W.L. 73511
+Schanz, M. 72670
Scharf, G. 70299
+Scharl, G. 72189
Schattke, W. 72580
+Schedl, M. 70348
+Schegelsky, V.A. 70408
Scheggi, A.M.+ 73655
+Scheibling, F. 70575
+Scheid, W. 70581
Scheiner, S.+ 70792
+Schellekens, A.N. 70288
+Schellman, H.M. 70399
Schepper, L.de .... *see* de Schepper, L.
+Scheurer, J.N. 70602
+Schick, M. 72252
Schickfus, M.von .... *see* von Schickfus, M.
+Schiemenz, P. 70443
+Schiffer, J.P. 70638
+Schiffini, L. 71900
+Schiller, A. 70219
Schilling, R.+ 72326
+Schilt, F.S. 73768
+Schimmerling, W. 70600
+Schimpf, J.H. 73659
Schink, H.K.+ 72484
Schinke, R. 72928
Schins, W.J.J.+ 72998
+Schippel, G. 70869
Schipper, P.E.+ 71853
+Schlatter, D. 70399
+Schlenter, W. 70663
+Schlesinger, M. 73009
Schlesinger, T.E.+ 72865
+Schloemer, E.C. 70457
Schlogl, F.+ 72078
+Schmeing, H. 70506
+Schmeits, M. 72465
Schmid, E.W. 70511
+Schmid, R. 71211
+Schmid, W. 72322
+Schmid, W. 72434
+Schmidt, A. 70645
+Schmidt, B. 72389
+Schmidt, I. 71905
+Schmidt, K.-H. 70641
Schmidt, M.+ 72821
+Schmidt, M. 72062
Schmidt, R.+ 71021
+Schmidt, V. 70829
Schmidt, W. 72678
Schmitt, K.+ 71807
Schmitt, P.+ 70927
Schmitt, P.+ 70911
+Schmitt, R.P. 70614
+Schmitt, R.P. 70618
Schmitt, W.+ 70695
Schmitt-Rink, S.+ 72325
Schmitt-Thomas, K.G.+ 73242
Schmitz, W.J., Jr.+ 73814
Schnehage, S.E.+ 70820
+Schneibel, J.H. 73198
Schneider, D.P.+ 74159
Schneider, F.+ 70980
+Schneider, F. 71866
+Schneider, H. 73188
Schnell, A.+ 72612
Schnell, R.C. 73878
+Schobbert, H. 70455
+Schober, H. 70691
Schockley, R.C.+ 73812
+Scholl, J.F. 74099
Scholten, O.+ 70605
+Schomer, P.D. 71301
+Schon, W. 72058
+Schon, W. 72061
+Schonhammer, K. 72886
+Schotte, K.D. 70006
Schow, F.L.+ 71180
+Schowengerdt, R.A. 73801
Schramm, D.N. 73964
Schrewe, U.J.+ 70506
+Schrieder, G. 70572
Schrittwieser, R. 71726
+Schroder, W.U. 70609
Schroeer, D.+ 69836
+Schubert, F. 70688
Schulkin, M. 71266
+Schull, D. 70572
Schuller, I.K.+ 72554
Schuller, I.K.+ 72031
Schulman, J.M.+ 70790
+Schulte, R. 70307
+Schultz, P. 71891
Schultz, P.H.+ 74015
+Schultz, R.A. 74015
+Schultze, K. 70307
Schulz, H.+ 74156
Schulz, H.+ 70570
+Schulz, P. 70874
Schulze, H.D.+ 70697
Schulze, K. 71314
+Schurmann, B. 70569
Schurmann, S.R. 74092
+Schuss, Z. 69993
+Schutte, G. 70468
+Schwalm, D. 70742
+Schwart, E. 74043
+Schwartz, G. 70752
+Schwartz, G. 74043
+Schwartz, G. 74046
+Schwartz, K.B. 71936
+Schwarz, E.W. 72233
Schweizer, H.+ 72434
+Schweizer, H. 72436
+Schweizer, H. 72322
+Schwendeman, R.H. 70974
+Schwerdtner, A. 71220
+Schwerer, H. 71948
Schwetlick, H. 71265
+Schwitters, R.F. 70399
Schwuttke, G.H. 72984
+Sconza, A. 70368
Scott, D.H. 74018
+Scott, D.K. 70604
Scott, G.W.+ 71163
+Scott, P.D. 73938
+Scott, R.E., Jr. 71319
+Scott, R.M. 70864
+Scoville, N.Z. 74165
+Scriven, L.E. 72187
+Scullman, R. 70898
+Sczerzenie, F. 73149
+Seaborg, G.T. 70624
Searle, T.M. 72864
Sears, V.F. 69799
+Sebacher, D.I. 73494
Sebastian, K.L. 69922
+Secco, E.A. 72098
+Secco, E.A. 72099
Sedaghat, M.+ 71372
+S'edin, V.Ya. 70152
+See, B.A. 71134
Seehra, M.S.+ 72828
+Seely, J.F. 71107
Segal, M.+ 73906
Segal, V.M.+ 72632
+Segall, R.L. 72019
Segawa, Y.+ 72329
+Segedy, J.J. 71068
+Segers, D. 72884
Segev, E.+ 70969
Segner, J.+ 72226
Seguin, M.K.+ 73714
+Seichert, N. 70443
Seidel, Chr.+ 72532
+Seidelmann, P.K. 74004
+Seidl, M. 73482
+Seielstad, G.A. 74176
Seifert, H.+ 72550
+Seiler, W. 73839
+Seiter, H. 73093
+Seiwert, M. 70463
Sejkora, G.+ 71680
+Sekar, R. 73760
+Seki, K. 72945
+Seki, M. 72830
+Seki, T. 74051
+Sekido, S. 73500
+Seliga, T.A. 73867
+Selivanov, A.S. 74008
+Sel'kin, A.V. 72327
+Selleri, F. 69917
+Sellmyer, D.J. 72607
+Sellmyer, D.J. 71896
Selloni, A.+ 72860
Selme, M.O.+ 72342
+Selyakov, V.I. 73800
Semary, M.A.+ 72585
+Semenchenko, A.F. 71670
+Semenets, S.M. 71355
+Semenov, A.S. 71233
+Semenov, A.S. 71128
+Semenov, A.T. 71127
Semenov, V.N.+ 71771
Semenov, Yu.G. 72579
Sementsov, D.I.+ 72774
Semenyuk, N.P.+ 71418
Semerad, E.+ 72922
Semiatin, S.L.+ 73151
Seminozhenko, V.P.+ 72593
+Semisalov, I.L. 70396
+Semitelou, I.P. 72588
+Semochkin, A.G. 73900
+Semon, M.D. 69826
Sen, P.K. 72748
Sen, S.K.+ 72167
Senchenkov, I.K. 71459
+Senjanovic, G. 70276
+Senna, M. 73061
+Senner, A.E. 70413
+Senoussi, S. 72615
+Sens, J.C. 70414
+Senseny, P.E. 73790
+Serdyuk, V.Z. 70751
Serdyuk, Yu.V.+ 72402
+Serebrennikova, T.A. 72171
+Seres, Z. 70552
+Sergeev, A.B. 71137
+Sergeev, A.B. 71128
Sergeev, N.A.+ 72655
+Sergeev, Yu.A. 71638
Sergent, C.Le .... *see* Le Sergent, C.
+Sergent, M. 71928
+Sergent, M. 72658
+Sergeyev, N.M. 70906
Sergienko, V.A.+ 70502
+Serna, C.R. 72196
+Serra-Lugaresi, P. 70368
+Serrano, C. 70966
+Serre, J. 72291
+Serri, J.A. 72913
Sese, L.M.+ 71848
+Seshan, K. 70082
Sessin, W. 73979
+Setchell, D. 72114
Setian, J. 71999
+Setsune, K. 72770
Settle, D.M.+ 73875
Setua, D.K.+ 73310
+Sevely, J. 70154
+Severdia, A.G. 72812
Seward, F.D.+ 74128
+Seward, F.D. 74096
Sexton, M.D. 73233
Seyal, M.+ 73608
Seyfried, M.+ 73631
+Seymour, K.St. 73714
Sfeir, A.A. 73473
+Shablii, I.Yu. 72845
Shabrin, A.N. 73835
+Shafi, Q. 70291
+Shagalov, M.D. 72450
Shaitan, K.V.+ 73508
+Shaitanov, S.P. 71186
+Shakhovtsov, V.I. 72506
Shakhtin, D.M.+ 72177
+Shalyaev, M.F. 71185
+Shalynin, A.I. 72425
Sham, T.-L. 71969
+Shamir, J. 71195
+Shamir, J. 71196
+Shanfield, Z. 73024
Shang Er-Chang .... *see* Er-Chang Shang
Shang-xue Qi .... *see* Qi Shang-xue
Shangjun Huang .... *see* Huang Shangjun
+Shanidze, R.G. 70413
+Shank, C.V. 71148
Shanks, T.+ 74178
+Shannon, R.D. 71936
Shao-hua Pan .... *see* Pan Shao-hua
+Shapira, D. 70617
Shapira, Y. 72227
+Shapiro, I.I. 74052
+Shapiro, I.I. 74033
+Shapiro, M. 70969
+Shapiro, S.L. 70117
+Shapiro, S.L. 74140
+Shapkin, P.V. 71233
+Shaposhnikov, V.M. 72007
Shapovalov, I.A.+ 73161
+Shapovalov, V.P. 72429
+Shareiko, P.N. 70413
Sharma, A.+ 70353
Sharma, B.K. 72132
Sharma, B.S.+ 71015
Sharma, C.S. 69854
+Sharma, D. 71526
+Sharma, H.O. 69936
Sharma, J.K.+ 73420
+Sharma, K.N.M. 73714
+Sharma, K.S. 70506
Sharma, M.G.+ 73617

+Sharma, N.K. 71866
Sharma, S.K.+ 70030
+Sharma, V.K. 73471
+Sharon, J. 73245
+Sharonova, L.V. 72488
+Sharp, D.H. 70017
Sharp, R.R.+ 73532
Sharp, R.R., Jr 69846
Sharpley, A.N. 73490
+Shashukov, E.A. 70671
Shatinskii, V.F.+ 71389
+Shatynski, S.R. 73270
+Shavel', N.N. 71210
Shaver, P.A.+ 74177
+Shaw, J.H. 70957
+Shaw, L.L. 71594
Shaw, N.B.+ 73205
+Shaw, R.A. 70729
+Shay, J.L. 72988
+Shcheglov, O.P. 74009
+Shcheglova, M.V. 73627
+Shchegoleva, L.G. 72506
+Shchepkin, V.D. 70091
+Shcherba, I.D. 72888
Shcherbakov, V.A. 71764
+Shcherbakov, Yu.A. 70751
+Shcherbenko, G.N. 72177
+Shcherbina, E.V. 72007
+Shchudlo, Yu.G. 72214
+Shchur, O.K. 73069
+She, C.Y. 73924
Shectman, S.A.+ 74152
+Shedova, E.N. 70128
+Sheftal, N.N. 72283
Sheiko, L.M.+ 73133
+Sheiko, L.M. 72649
Sheinman, I.+ 71414
Sheka, E.F.+ 69810
+Sheksheyev, E.M. 73543
+Sheldon, P.D. 70399
+Sheleg, A.U. 72763
+Shelest, V.P. 70324
+Shen, B.C. 70585
+Shen, Y. 71304
Shen Hong-yuan+ 71129
+Shen Tie-Han 71870
+Shen Wen-qing 70565
+Sheng, P. 72406
Sheng Lian-gen+ 72745
Shengnian Huang .... *see* Huang Shengnian
+Shenoy, G.K. 72636
Shepard, J.R.+ 70550
+Shepard, J.R. 70549
+Sheppard, R.J. 73529
+Sheppard, R.J. 73552
+Sher, A. 72305
Sher, M. 70283
+Shera, E.B. 70489
+Sherbini, G.M. 73253
+Sherden, D.J. 70394
+Sheremet'ev, V.N. 72771
+Sherif, M.M. 70560
+Sherman, E.A. 72185
+Sherman, M.G. 70138
+Sheroziya, G.A. 71707
+Sherrington, D. 72618
Sherry, J.E.+ 73888
+Shershenkova, E.Yu. 73211
+Shesterikov, S.A. 73584
Shevchenko, M.Yu. 74003
+Shevtsova, L.A. 71451
+Shewmon, P.G. 73200
+Shi En-dong 71952
+Shi Fangyong 71028
+Shi Fangyong 71031
Shi-chang Zou .... *see* Zou Shi-chang
Shi-xin Yuan .... *see* Yuan Shi-xin
Shiba, H.+ 72581
+Shibaev, V.V. 73236
Shibahara, M.+ 71503
Shibata, F.+ 72654
+Shibata, T. 73143
+Shibuya, S. 72830
+Shida, T. 70920
+Shiga, M. 73084
Shigematsu, H.+ 69988
+Shigematsu, T. 69885
+Shigesawa, H. 71062
Shih, E.H.H.+ 73801
+Shik, A.Ya. 72488
+Shikin, A.M. 72495
+Shilov, V.V. 71878
+Shilovich, A.I. 73019
Shima, A. 70464
Shima, A. 70757
Shima, A.+ 71609
Shima, A.+ 71612
+Shima, A. 71610
+Shima, A. 71611
Shima, K. 70282
+Shimada, M. 73052
Shimada, S.+ 73041
+Shimada, T. 73294
Shimaya, M.+ 72508
Shimizu, A.+ 72537
+Shimizu, E. 71080
Shimizu, H.+ 73924
+Shimizu, H. 71121
+Shimizu, M. 72650
+Shimoda, T. 70593
Shimony, Y.+ 71943
+Shimoura, S. 70593
+Shimura, S. 73619
Shin, H.K. 70993
+Shin, S. 72830
+Shindo, Y. 70935
Shing-nan Yu .... *see* Yu Shing-nan
+Shinosaki, K. 73557
Shinouda, M.R. 71401
+Shints, Ya.O. 71709
+Shiogai, T. 71323
Shiohara, Y.+ 72089
Shiojiri, M.+ 72274
+Shiokawa, J. 72392
+Shiono, N. 72508
Shiotani, M.+ 70921
+Shirakawa, K. 72601
+Shirley, D.A. 72953
+Shirley, D.A. 72966
+Shirmin, G.I. 73981
Shirokova, A.A.+ 70521
Shirota, Y.+ 72945
+Shishikui, Y. 71834
Shitikov, Yu.L.+ 72064
+Shitikova, K.V. 70521
Shivamoggi, B.K. 71788
+Shivaprasad, S.M. 72517
Shive, J.N.+ 69808
Shiwa, Y.+ 72463
Shiying Ding .... *see* Ding Shiying
Shiying Yu .... *see* Yu Shiying
Shizuma, K.+ 70452
+Shkerdin, G.N. 72767
Shkrebtii, A.I.+ 72503
+Shkunov, V.V. 71071
+Shkuratov, Yu.G. 74002
Shlomo, S. 70465
+Shlyakhtenko, P.G. 70111
+Shlyapnikov, G.V. 72180
+Shmartsev, Yu.V. 72488
Shmelev, G.M.+ 72455
+Shmelev, G.Ye. 73687
Shmid, M.+ 70634
+Shmitt-Fogelevich, S.P. 73047
+Shobatake, K. 70950
+Shockey, D.A. 73179
Shohet, J.L. 71784
Shoja-Chaghervand, P.+ 70974
+Shokin, Yu.I. 69890
Sholkovitz, E.R. 73488
Shon Nguyen Hong .... *see* Nguyen Hong Shon
+Shorin, V.V. 70671
+Shotov, A.P. 72881
+Shotter, A.C. 70619
Shou-zheng Wang.. *see* Wang Shou-zheng
+Shpak, M.T. 72277
+Shriner, J.F., Jr. 70528
Shrive, N.G. 73196
+Shrock, R.E. 72569
+Shtarkov, L.N. 70413
+Shtepa, Yu.D. 72313
+Shtipel'man, Ya.I. 72981
Shu Chang-qing+ 72105
Shu-Lin Zhang .... *see* Zhang Shu-Lin
Shu-yu Zhang .... *see* Zhang Shu-yu
Shu-zhen Liu .... *see* Liu Shu-zhen
+Shuba, Yu.A. 72939
+Shul'ga, M.O. 71435
Shul'ga, N.A. 71456
Shul'ga, N.A.+ 71452
+Shul'ga, N.A. 72045
+Shul'gin, V.I. 71631
Shul'man, Z.F.+ 71570
+Shumilkina, E.A. 71624
+Shumovskii, A.S. 71099
Shun-chen Pan .... *see* Pan Shun-chen
Shung, K.K. 71267
+Shuppe, G.N. 72934
+Shuvalov, V.V. 71204
+Shvarts, A.S. 69969
Shvartsburg, A.B. 71754
+Shvedchikov, A.V. 70542
+Shvets, R.N. 71422
Shvidler, M.I. 71640
+Shyam, M. 70589
Shyam, R.+ 70619
+Shyam, R. 70606
Shypit, R.+ 70539
+Si Cheng-cai 72976
Sibbett, W.+ 71154
+Sibener, S.J. 72224
+Sibul, L.H. 69858
Sichel, E.K.+ 72406
Siddagangappa, M.C.+ 71826
Sidlichovsky, M. 73976
+Sidorenko, E.A. 70060
+Sidorov, S.K. 71929
+Sidorov, V.I. 72403
+Sidoryuk, I.E. 72007
+Sidoryuk, O.E. 72009
+Siegbahn, K. 70951
+Siegbahn, P.E.M. 70955
+Siegel, J. 73692
+Siegel, R.T. 71041
+Siegel, R.W. 72349
+Siegmann, W.L. 71290
Siegrist, M.R.+ 71790
+Siegrist, P. 70418
+Siemssen, R.H. 70591
+Siemssen, R.H. 70518
+Sienkiewicz, R. 74073
Sierra, G.+ 70215
Sigman, R.K.+ 71625
+Sigmon, T.W. 71985
Sigmond, R.S.+ 71833
Sigov, Yu.S. 71733
+Sigovtsev, G.S. 71615
+Sikhorskii, Yu.S. 72218
+Sikka, V.K. 73148
Sikora, R.+ 72097
Silberberg, A. 73618
+Silberberg, Y. 71101
+Silberman, J.A. 73239
+Silberman, J.A. 72305
+Silenok, A.S. 71758
+Silin, V.P. 71732
Silk, J.+ 73985
Silk, J.D.+ 70608
Silva, A.Ferreira da .... *see* Ferreira da Silva, A.
Silva, F.H.Lopes Da .... *see* Lopes Da Silva, F.H.
Silva, J.Andrade e .... *see* Andrade e Silva, J.
Silvertooth, E.W.+ 70109
+Sil'vestrov, L.V. 70413
+Simecek, P. 70485
+Simeoni, D. 71805
+Simitses, G.J. 71414
+Simkiene, I. 72409
+Simmonds, P.E. 72825
+Simmons, A.J. 70405
Simon, M.de Saint .... *see* de Saint Simon, M.
+Simon, R.S. 74176
+Simon, S. 70618
+Simonetta, M. 73332
Simonich, D.M.+ 73953
+Simonneau, E. 70818
+Simonneau, E. 70819
Simonov, K.V.+ 73045
+Simonov, V.E. 70413
+Simonova, N.V. 71795
Simons, G.A. 73362
Simons, J.P.+ 70932
Simons, S. 69827
Simonson, G.F.+ 74144
+Simpson, C.J.S.M. 70994
+Sims, J. 70664
+Sinclair, A.T. 74004
+Sinclair, G.R. 72666
+Sinex, D.G. 73592
Sing, K. 69811
Singa Rao, K.+ 71431
+Singal, S.P. 73854
Singer, M.+ 70287
Singer, P. 70389
Singer, P. 70390
Singh, A.+ 72730
+Singh, B.M. 71475
Singh, C.P.+ 70376
+Singh, D.P. 72047
Singh, G.P.+ 71913
Singh, J.P.+ 71382
+Singh, J.P. 71381
+Singh, K. 71083
+Singh, N. 72367
Singh, P.C.+ 71675
Singh, R. 70579
+Singh, R. 70623
+Singh, R.A. 72385
+Singh, R.N. 71083
+Singh, R.N. 71214
+Singh, S. 70256
+Singh, S. 71675
Singh, S. *(ed.)* 69787
Singh, S.K.+ 70916
+Singh, V. 70380
Singhal, A.K.+ 71214
+Sinha, B. 70520
+Sinha, P.C. 73804
+Sinha, S.N. 73614
+Sinha, S.N. 73615
+Sinha, S.N. 73616
+Sinigaglia, D. 73260
+Sinigaglia, D. 73261
Sink, M.L.+ 70758
+Sink, M.L. 70986
Sinkkonen, J.+ 72332
+Sinkovic, B. 72964
+Sinopoli, L. 70635
Sinyatynskii, A.A.+ 72881
+Sinzi, A.M. 74004
+Siohan, F. 73963
+Sipovskaya, M.A. 72354
+Sirdeshmukh, D.B. 72074
Sirivat, A.+ 71527
+Sirlin, A. 70367
+Sironi, G. 73995
Sirota, D.I.+ 72645
+Sirotinin, E.I. 72021
+Sirutkaitis, V.A. 70958
+Sistemich, K. 70452
+Sitar, B. 70750
+Sitdikov, A.M. 71958
+Sitnikov, S.F. 71157
Sivakumaran, N.S.+ 71669
+Sivaramakrishnan, C.K. 70632
Sivashinsky, G.I. 71522
Sivashinsky, N.+ 71509
+Siwek-Wilczynska, K. 70591
+Siwek-Wilczynska, K. 70518
Sixl, F.+ 73512
Sixou, P.+ 71869
Sizer, T., II+ 71136
Sjoreen, T.P.+ 70617
+Skiff, B.A. 74049
+Skiff, B.A. 74051
+Skinazi, J. 71697
+Skopin, I.A. 71128
Skorozda, R.V.+ 72633
+Skoryukov, A.G. 72469
+Skotnikov, V.P. 71548
+Skoulios, A. 71873
Skul'skii, I.A.+ 73549
+Skumriev, V. 72586
+Skvortsov, L.A. 72007
+Skvortsov, L.A. 72009
+Sladkov, A.M. 71924
Slagter, R.J. 74185
+Sleep, N.H. 74006
+Sleep, N.H. 73761
+Slempkes, S. 72521
+Slepchenko, L.A. 70323
+Slepets, L.A. 70413
+Slesarev, V.N. 72422
Sletten, E.+ 70909
+Sletten, G. 70432
+Slivka, V.Yu. 72751
+Slobodyanyuk, A.V. 72814
Slobozhanina, Ye.I.+ 73542
+Slocum, J.E. 73598
+Slodzian, G. 72243
+Slokar, G. 73059
+Slominskii, Yu.L. 71167
Slotin, L.A. 73486
+Slotsenietse, E.A. 72874
+Sloushch, V.G. 73047
+Slutz, S.A. 70737
+Smailos, E. 70673
+Small, G.J. 73380
Smedman, A.-S.+ 73862
+Smeets, A.H.M. 71825
+Smetannikova, Yu.S. 72354
+Smidt, J. 72710
+Smirl, A.L. 71189
+Smirnov, A.B. 72939
+Smirnov, B.N. 71924
+Smirnov, O.M. 72902
+Smirnov, V.S. 70120
+Smirnov, V.S. 70121
+Smirnov, Yu.G. 70826
+Smirnova, N.A. 73954
Smirnova, T.P.+ 72217
+Smith, A.C.H. 71023
+Smith, A.J. 70932
Smith, B. 73713
+Smith, B.A. 74004
Smith, C. 70010
Smith, C.H.Llewellyn .... *see* Llewellyn Smith, C.H.
+Smith, D. 71144
+Smith, D.I. 73591
Smith, D.J.+ 71954
+Smith, D.J. 71981
+Smith, D.J. 71980
Smith, E. 72037
Smith, E.+ 73178
Smith, G.+ 73941
+Smith, G.A. 70405
+Smith, G.C. 72958
Smith, G.H. 74122
Smith, H.A.+ 74133
+Smith, J.L. 72533
+Smith, J.R. 72339
Smith, L.S.+ 73921
Smith, L.W.+ 70020
Smith, M.A.H.+ 73885
Smith, P.J.+ 72145
+Smith, R.C. 70075
+Smith, R.J. 72951
+Smith, R.L. 73095
+Smith, R.W. 73003
Smith, T.B. 69924
Smith, V.+ 74044
Smithson, T.L.+ 70857
+Smizanska, M. 70413
+Smolin, M.D. 73028
+Smolyanskii, S.A. 70232
+Smolyarenko, E.M. 72763
+Smooha, Y. 73140
Smooke, M.D. 69933
Smrcek, K.+ 73430
Smy, P.R.+ 71805
Smye, S.W.+ 73672
+Snail, K.A. 73424
Sneden, C.+ 74068
+Snegirev, V.V. 72680
+Snegurskii, A.V. 70754
+Snezhnoi, V.L. 72649
Sniatycki, J.+ 70186
+Snitko, O.V. 72503
Snyder, L.E.+ 74039
+Snyder, R.S. 73545
+Sobel'man, I.I. 71029
+Sobel'man, I.I. 73330
+Sobel'man, I.I. 73351
+Sobiczewski, A. 70628
+Sobolev, A.G. 72869
+Sobolev, V.L. 72593
+Soboleva, E.M. 72869
+Sobolov, I.A. 70680
+Socher, W. 72691
+Soedel, W. 71429
+Soff, G. 70830
+Soff, G. 71047
Soffer, A. 70242
Sogo, K.+ 72574
+Sohma, J. 70921
+Sokolov, A.A. 70531
Sokolov, A.M.+ 72460
+Sokolov, A.P. 73833
+Sokolov, M.A. 72504
+Sokolov, M.V. 70553
+Sokolov, V.I. 71157
+Sokolov, V.V. 73344
Sokolovskaia, A.I.+ 71089
+Sokolovski, B.Yu. 70636
+Sokolovskii, M.Ya. 72632
+Sokolowski, R.S. 72167
Sokovishin, Yu.A.+ 71553
+Soldatova, E.A. 73219
+Soler, J.M. 72925
Soliman, M.+ 71428
+Solin, S.A. 71945
+Solmi, S. 72119
+Solodkov, A.F. 71127
+Soloev, Yu.I. 73208
Solomon, P.M.+ 72482
Solomon, S.C.+ 74007
Solomon, S.C.+ 74012
Solovei, S.S. 73483
+Solov'ev, E.E. 72688
Solov'ev, M.A. 70230
+Solov'ev, V.A. 73135
+Solov'ev, Yu.A. 70081
+Solov'eva, E.V. 70748
+Soloviev, Yu.V. 70413
Solt, G.+ 71984
+Solyakin, G.E. 70636
+Som, M.M. 69945
Soma, T.+ 72084
Somashekar, B.R. 71373
+Somerford, D.J. 70030
+Somerville, P. 73740
+Sommeregger, E.F. 73991
+Somorjai, G.A. 72205
+Son, D. 70309
+Son, D.-K. 71542
Sona, A.M.Bizzeti .... *see* Bizzeti Sona, A.M.
Sonek, G.J.+ 71223
+Song, J.C. 71629
+Song, S. 70592
+Song, S. 70603
Song Tian-xia 71350
+Song Xing-chang 70177
Soni, S. 73701
Sonius, M.E.+ 71902
+Sonnenschein, J. 70273
+Sonnenschein, J. 70289
+Sonobe, B.I. 73355
+Soong, D.S. 71509
Sooryakumar, R.+ 72825
Sopori, B.L.+ 73455
Soramasu, N.+ 73667
+Soriano, R. 70136
Sorkin, B.A.+ 72972
+Sorokin, A.A. 72718
Sorokin, S.V.+ 69903
+Sorokin, S.V. 70304
+Sorokin, V.N. 73348
+Sorokin, V.N. 73349
Sorokodum, E.D. 71564
Sosnitskii, S.P. 69871
Sosnowski, J.+ 72578
+Sotier, S. 72395
Sotomura, T.+ 73500
+Souriau, M. 73757
+Sourisseau, C. 71912
+Sousa, C.A. 70473
+Soussaline, F. 73697
+Southcott, B.M. 73651
+Souza, M.H.G. 70415
+Spaepen, F. 72081

Spagna, G. ... 69844
Spagnolo, F.A.+ ... 71068
Spalink, J.D.+ ... 73531
+Spandre, G. ... 70752
+Spanget-Larsen, J. ... 70946
Spasov, A.Ya.+ ... 69895
+Spasskii, A.V. ... 70530
Spear, R.J.+ ... 70072
+Spear, W.E. ... 72698
Speciale, M.+ ... 71254
Spedding, J.+ ... 73840
+Sperling, W. ... 73531
Spero, R. ... 69972
Spicer, W.E.+ ... 72305
+Spicer, W.E. ... 73239
+Spiel, D.E. ... 73880
+Spiess, G. ... 70963
+Spink, G.M. ... 73205
Spinrad, R.W.+ ... 73821
+Spiridenkov, E.M. ... 70408
Spirito, P.+ ... 73463
Spitsyn, V.I.+ ... 70657
Spitsyn, V.I.+ ... 70698
+Spittel, U. ... 70890
+Spitzer, W.G. ... 71983
Spooner, S.+ ... 73063
+Sporea, D. ... 70751
+Sporykhin, A.N. ... 71407
+Sporykhin, A.N. ... 71417
+Spriggs, R.M. ... 73022
+Sprung, K.-R. ... 72511
Spurny, F.+ ... 70749
+Srdanov, V.I. ... 73327
+Srednicki, M. ... 70278
+Srednicki, M. ... 69964
+Sreekantan, B.V. ... 73997
+Srinivasan, M. ... 73218
Srinivasan, M.V. ... 73570
+Srinivasan, R. ... 70067
+Srirangarajan, H.R. .. 71347
Srivastava, L.M.+ ... 73614
Srivastava, L.M.+ ... 73615
Srivastava, L.M.+ ... 73616
+Srivastava, S.K. ... 70987
+Srivastava, V.P. ... 73614
+Srivastava, V.P. ... 73615
+Srivastava, V.P. ... 73616
Srivastava, Y.+ ... 70183
+Sroubek, Z. ... 72926
Srulovicz, P.+ ... 73587
Staab, G.H. ... 71466
+Staaf, O. ... 70823
+Stabnikov, M.V. ... 70751
Stacey, F.D. ... 73704
+Stadnyk, Yu.V. ... 72633
+Staehli, J.-L. ... 72435
+Stafl, M. ... 71056
+Stafsudd, O.M. ... 71138
Stair, P.C. ... 72946
Stallard, W.A.+ ... 71122
+Stals, L. ... 72884
+Stamatescu, I.O. ... 70219
+Stamm, M. ... 72331
Stammler, W.W. ... 73745
+Stanco, E. ... 71105
+Stankov, B.B. ... 73874
Stanton, T.K. ... 71286
Staples, B.A.+ ... 70699
Stapp, H.P. ... 70357
Stapp, H.P. ... 70358
Staring, E.+ ... 69833
+Staring, M. ... 69833
+Stark, L. ... 73569
+Starodubtsev, Yu.N. ... 72632
+Starov, V.M. ... 71644
Staszewska, G.+ ... 70991
Statler, R.L.+ ... 73441
+Stattmayer, P. ... 74049
+Stauffer, D. ... 70007
+Staunton, J. ... 70913
+Steba, A.M. ... 71184
+Stebbins, A. ... 73985
Steblyanko, V.A.+ ... 73890
Steck, D.J.+ ... 69831
+Stedman, G.E. ... 71175
Steeb, W.-H.+ ... 69925
Steel, L.K.+ ... 73641
Steele, R.+ ... 71170
Steeples, K.+ ... 72383
+Stefanik, R.P. ... 74152
+Stegeman, G.I. ... 72820
+Steinberg, E.P. ... 70517
+Steinberg, R.I. ... 70274
+Steinberg, R.I. ... 70745
+Steindler, M.J. ... 70703
+Steindler, M.J. ... 70687
Steinling, M.+ ... 73697
+Steinolfson, R.S. ... 73983
+Stejskal, V. ... 69864
+Stekas, J. ... 70419
+Stella, A.L. ... 70009
+Stellwag, B. ... 73286
+Steltzer, H. ... 70587
+Stelzer, H. ... 70576
+Stelzer, H. ... 70517
+Stencel, R.E. ... 74113
+Stenflo, L. ... 71742
Stenholm, S. ... 70810
+Stenzel, R.L. ... 71699
+Stepanov, B.M. ... 70161
+Stepanov, B.M. ... 71252
Stepanov, I.A.+ ... 73082
+Stepanyants, Yu.A. .. 71626
Stephan, G. ... 71103
Stephan, K.+ ... 71025
+Stephens, R.W.B. ... 72054
+Stepkin, V.I. ... 72900
+Sterbenz, S.M. ... 70457
+Sterling, T. ... 70172
+Stern, C. ... 71800
+Stern, M. ... 72834
Stern, R.M., Jr.+ ... 73598
+Stern, S.A. ... 74037
Stern, W.+ ... 71812
+Sternberg, S. ... 70015
+Sterrenburg, W.A. ... 70591
+Stetsenko, A.G. ... 71588
Stevens, A.E.+ ... 70947
+Stevens, J. ... 71729
Stevens, R.A.+ ... 73112
+Stevenson, N.R. ... 70539
Stewart, B.W. ... 69942
+Stewart, W.J. ... 71245
+Stewartson, K. ... 71535
+Stiegler, J.O. ... 72018
+Stiller, W. ... 71021
Stillinger, F.H.+ ... 71683
+Stillman, G.E. ... 72524
+Stillman, G.E. ... 72404
+Stinchcombe, R.E. ... 72628
+Stingeder, P. ... 72932
Stix, M.S.+ ... 71150
+Stizza, S. ... 72776
Stobbs, W.M. ... 73083
+Stobbs, W.M. ... 71981
+Stobbs, W.M. ... 71979
+Stobbs, W.M. ... 71845
+Stocks, G.M. ... 72288
+Stodolny, A. ... 72110
+Stoffel, N. ... 72251
Stoffel, N.G.+ ... 72965
+Stohr, J.F. ... 73118
+Stokes, A. ... 71523
+Stola, L. ... 73866
Stolka, M + ... 72447
+Stoller, Ch. ... 71000
+Stolwijk, N.A. ... 72151
+Stolyarov, V.L. ... 72630
+Stolz, H. ... 72863
Stone, C.A.+ ... 72989
Stoneham, A.M. ... 72181
+Storchak, V.V. ... 73308
+Storey, J.W.V. ... 74135
+Stori, H. ... 72467
+Storozhev, V.I. ... 71437
Stout, M.G.+ ... 71467
Stout, M.G.+ ... 73169
Stover, L.J.+ ... 73596
+Strack, B. ... 70610
Stradling, G.L.+ ... 70159
+Stradling, R.A. ... 72347
Strain, M. ... 71511
+Strait, J. ... 70399
+Strakhov, V.N. ... 73758
+Strakhovenko, V.M. .70300
+Strandjord, A.J. ... 70940
Strandord, A.J.G.+ ... 70939
+Strangway, D.W. ... 73715
+Strathdee, J. ... 70206
+Strathdee, J. ... 70207
Strazzeri, A. ... 70515
Street, A.J.+ ... 70056
Streeter, L.A.+ ... 73606
+Streibel, H.J. ... 71055
+Streitmatter, R.E. ... 73963
+Strelets, M.Kh. ... 71546
+Strel'nikov, A.S. ... 70671
Strelyaev, V.S.+ ... 71405
+Strikha, V.I. ... 72501
+Stril'ko, S.I. ... 72470
+Strizhevskii, V.L. ... 71184
+Strizhevskii, V.N. ... 72485
+Strizhov, V.F. ... 71771
+Strobel, G.L. ... 71171
+Strok, L.P. ... 73175
Stromeyer, C.F. ... 73573
Strominger, A. ... 70167
+Strong, D.F. ... 73756
+Strongin, M. ... 72952
+Stroud, D. ... 72368
Strow, L.L. ... 70871
+Struchkov, Yu.T. ... 71035
+Struk, I.I. ... 73348
+Struk, I.I. ... 73349
Strumia, A. ... 70180
Strumia, A. ... 71666
+Struwe, H. ... 71316
+Struzhko, B.G. ... 70553
Struzinski, W.A. ... 71308
Stubenrauch, C.F.+ ... 70041
+Stubican, V.S. ... 73071
+Stubican, V.S. ... 73072
+Stulz, J. ... 70861
+Stulz, L.W. ... 71135
Stumm, W. ... 73289
+Stupitskii, E.L. ... 71760
+Sturman, B.I. ... 72451
+Sturman, B.I. ... 72424
+Stwertka, P.M. ... 70622
+Styczen, B. ... 72917
Su, J.H.+ ... 71443
+Suarez, B. ... 71374
+Suarez, B. ... 71375
+Subachyus, L.E. ... 72500
Subba Ramaiah, K.+ .. 72667
Subramanian, A.+ ... 71498
Subramanyam Reddy, K.+ ... 72023
+Suchkin, G.L. ... 73981
+Sudakov, G.G. ... 71589
Sudareva, S.V.+ ... 71930
+Sudarshan, E.C.G. ... 70277
+Sudarshan, E.C.G. ... 69932
Suehiro, K.+ ... 73294
+Suekane, M. ... 72306
+Suenram, R.D. ... 70852
+Sueta, T. ... 71227
+Sueta, T.D. ... 71078
+Suetin, N.V. ... 71820
+Suffritti, G.B. ... 72212
Suga, S.+ ... 72830
+Suga, S. ... 72949
Sugai, S.+ ... 72832
Sugakov, V.I.+ ... 72313
Sugano, M.+ ... 74051
+Sugano, S. ... 72653
+Sugar, J. ... 70815
+Sugata, K. ... 73368
+Sugihara, T.T. ... 70614
+Sugimoto, I. ... 71259
+Sugimoto, K. ... 73282
+Sugimoto, N. ... 73925
+Sugimoto, N. ... 70891
+Sugino, T. ... 71121
Suhai, S. ... 70786
Suit, H.D. ... 73636
+Sujkowski, Z. ... 70518
+Sukharevskii, V.G. ... 70532
Sukharevsky, V.G.+ ... 70538
Sukhonosov, V.I. ... 73865
+Sukhorukov, Yu.P. ... 70101
Sukhov, M.F.+ ... 73107
Sukhovich, E.P. ... 71529
+Sukhovsky, A.A. ... 72740
Sulentic, J.W.+ ... 74154
Sulentic, J.W.+ ... 74166
+Sulikov, N.A. ... 73526
+Sullivan, J.L. ... 72947
Sullivan, J.P.+ ... 70618
Sullivan, T.M.+ ... 72160
+Sultanov, G.G. ... 70413
+Sul'zhenko, V.K. ... 73220
+Sumachev, V.V. ... 70542
Sumbera, M.+ ... 70537
+Sumbera, M. ... 70588
Sumino, K. ... 71963
+Sumita, M. ... 72669
Sumiyama, K.+ ... 72276
Sumiyama, K.+ ... 73084
+Summers, S.E. ... 73266
Summhammer, J.+ ... 70738
+Sun, D.K. ... 73275
Sun, F.+ ... 73569
Sun Hong Zhou+ ... 70433
Sun Hur-bin+ ... 72207
+Sun Jue ... 73610
Sun-Sheng Yi ... *see* Yi Sun-Sheng
Sunagawa, I. ... 73793
+Sunandana, C.S. ... 73190
+Sunaoka, F. ... 71403
Sundararaman, D.+ ... 73090
+Sunder, S. ... 72778
Sung Tae Ahn+ ... 73274
Sung Young-Kwon ... *see* Young-Kwon Sung
+Sung-Chul Ha ... 71684
+Sung-Kil Yang ... 70220
+Sunier, J.W. ... 70438
+Sunrinach, S. ... 71887
+Suquet, P. ... 71392
Surana, K.S. ... 69883
Surdo, C.Lo ... *see* Lo Surdo, C.
Suresh, S.+ ... 73277
Surkov, Yu.A.+ ... 74009
+Surkova, I.V. ... 70429
+Surlyk, F. ... 73796
+Sushkov, O.P. ... 70450
+Sushkov, O.P. ... 70794
Suslikov, L.M.+ ... 72751
Sutcliffe, J.F.+ ... 73657
+Sutherland, J.M. ... 72147
+Sutherland, P.G. ... 74096
Suto, M.+ ... 70944
+Sutton, D. ... 73589
+Sutyagin, V.A. ... 72813
+Suvorov, D.N. ... 73348
+Suvorov, E.V. ... 71766
Suwara, M. ... 70327
Suydam, B.R. ... 71191
Suzuki, M.+ ... 73602
+Suzuki, M. ... 73340
+Suzuki, M. ... 72556
+Suzuki, N. ... 70423
+Suzuki, N. ... 72581
+Suzuki, S. ... 72499
+Suzuki, T. ... 72445
Suzuki, Y.+ ... 72683
+Suzuki, Y. ... 72682
Svab, E.+ ... 71903
+Svanidze, T.M. ... 72491
+Svechnikov, S.V. ... 72441
+Sverzellati, P. ... 70383
+Svirko, Yu.P. ... 71174
+Svirko, Yu.P. ... 71877
+Swaminathan, V. ... 72163
+Swamy, H.R. ... 72782
Swamy, K.S.Krishna ... *see* Krishna Swamy, K.S.
+Swan, Y.A. ... 72388
+Swank, J.H. ... 74103
+Swanson, J.E. ... 73630
Swee Lian Tan+ ... 71922
+Sweedler, I.K. ... 73641
+Swendsen, R.H. ... 72204
+Swift, J.B. ... 71874
Swindeman, R.W.+ ... 73148
Swiniarski, R.de ... *see* de Swiniarski, R.
+Sychev, N.I. ... 71932
Sykja, B.+ ... 69977
Symon, K.R. ... 71723
Symonds, B.L.+ ... 73180
+Symons, D.T.A. ... 73714
+Symons, T.J.M. ... 70604
+Symons, T.J.M. ... 70608
+Sysoev, V.K. ... 71110
+Szafran, M. ... 73364
+Szanto de Toledo, A. ... 70640
Szasz, A.+ ... 72893
Szasz, A.+ ... 72890
+Szasz, A. ... 72892
+Szasz, A. ... 72891
Szauer, T. ... 73258
Szauer, T.+ ... 73257
+Szczepanska, H. ... 70835
Szczesniak, E.+ ... 72693
+Szigethy, D. ... 72761
+Szigeti, E. ... 72279
+Szostak, D. ... 71033
Sztajno, M.+ ... 74109
+Szustakowski, M. ... 71305
Szwed, J. ... 70412
+Szybisz, L. ... 70505
Szydlowski, M.+ ... 74187
Szymanski, G. ... 71059
Szymczak, C. ... 71415
+Szymkowiak, A.E. ... 74103

't Hooft, G.W.+ ... 72481
+Tabata, T. ... 71977
+Tabunov, V.P. ... 71127
+Tacconi, L.J. ... 74165
+Tachi, T. ... 73983
+Tachiki, M. ... 72556
Taconet, O.+ ... 73857
+Tada, Y. ... 71852
+Taddeucci, T.N. ... 70561
+Tadjbakhsh, I.G. ... 71430
Tae Ahn Sung *see* Sung Tae Ahn
+Taft, B.A. ... 73820
Taguchi, I.+ ... 72810
+Tailor, P.R. ... 70066
+Tain, J.L. ... 72917
Tain Fu Gao+ ... 71276
Tajima, M. ... 72856
+Tajima, M. ... 72840
+Tajiri, F. ... 71121
+Tak Jin Moon ... 71509
+Tak San Ho ... 71009
+Tak San Ho ... 71010
+Takacs, L. ... 71879
Takacsy, N.de ... *see* de Takacsy, N.
+Takada, E. ... 70593
+Takagi, O. ... 73292
+Takagi, S. ... 73947
Takahashi, H.+ ... 70886
Takahashi, H.+ ... 72809
Takahashi, H.+ ... 71259
Takahashi, K. ... 72268
Takahashi, K.+ ... 71890
Takahashi, S.+ ... 72651
+Takahashi, Y. ... 70626
Takano, T.+ ... 71678
Takaoka, S.+ ... 72426
Takarabe, K.+ ... 72802
+Takasu, S.-I. ... 72840
+Takasugi, E. ... 70504
+Takasugi, T. ... 73147
Takayama, K.+ ... 71604
Takeda, S.+ ... 71982
+Takeda, T. ... 71977
+Takeda, Y. ... 71241
Takeishi, S.+ ... 70085
+Takemura, H. ... 71152
+Takemura, T. ... 70935
+Takenaga, M. ... 73667
+Takeno, Y. ... 72270
+Takeshita, I. ... 73470
+Takeuchi, M. ... 72446
Takeuchi, N.+ ... 73925
+Takeuchi, N. ... 70891
+Takeuchi, T. ... 72343
Takezawa, S.+ ... 70891
+Takhtamyshev, G.G. ... 70413
+Takishima, T. ... 73619
Taktarov, N.G. ... 71665
+Talavera, A. ... 74047
+Talkner, P. ... 69996
Talmi, I. ... 70466
+Talukdar, B. ... 70509
+Tal'yanskaya, N.D. .. 73156
+Tam, P.Y. ... 73517
+Tamai, S. ... 73125
+Tamain, B. ... 70592
+Tamain, B. ... 70603
+Tamain, J.C. ... 70753
Tamanis, M.Ya. ... 70942
Tamari, N. ... 71125
+Tamberg, Yu.Ya. ... 70487
+Tamir, A. ... 72122
+Tampieri, F. ... 73858
+Tamura, E. ... 72584
+Tamvakis, K. ... 70378
+Tamvakis, K. ... 70278
+Tan Ji-chun ... 71027
Tan Swee Lian ... *see* Swee Lian Tan
+Tanabaum, H. ... 74172
+Tanabe, Y. ... 73056
+Tanaka, H. ... 70567
+Tanaka, J. ... 71609
+Tanaka, J. ... 71612
+Tanaka, K. ... 72355
+Tanaka, M. ... 73886
+Tanaka, M. ... 72991
+Tanaka, M.-K. ... 70593
+Tanaka, R. ... 72684
Tanaka, S.+ ... 73604
Tanaka, S.+ ... 71701
+Tanaka, S. ... 71152
+Tanaka, Y. ... 70489
+Tananbaum, H. ... 74173
Tanarro, I.+ ... 71020
+Tandy, P.C. ... 70600
Tanemoto, K.+ ... 73431
Tang Di-sheng+ ... 72638
+Tang Hsiao-wei ... 72883
Tani, A. ... 71856
+Tanigaki, M. ... 71852
+Taniguchi, M. ... 72267
+Taniguchi, M. ... 72949
+Taniguchi, M. ... 72830
Tanikawa, K. ... 73980
+Tanikawa, K. ... 71046
+Tanimoto, A. ... 71555
+Tanimoto, M. ... 72682
+Tanimura, M. ... 73294
Tanino, H.+ ... 72787
Tanner, A.C.+ ... 70978
+Tanner, D.B. ... 72547
+Tanner, T.M. ... 73385
+Tanoue, H. ... 70145
Tanoue, K.+ ... 73128
+Tanuma, S. ... 72560
+Tanuma, S. ... 72559
+Taormina, A. ... 70255
+Tapiero, M. ... 72189
+Taqui Khan, M.M. ... 70873
+Taranenko, S.T. ... 70048
+Taranichev, V.E. ... 72630
+Tarantov, Yu.A. ... 72526
+Tarantov, Yu.A. ... 72874
+Tarasenko, V.P. ... 72491
+Tarasenko, V.V. ... 72647
+Tarasov, G.G. ... 72314
+Tarasov, N.A. ... 70633
+Tare, V.B. ... 73358
+Tarelkin, S.M. ... 70049
+Tarkanyi, F. ... 70507
+Tarnay, K. ... 71997
+Tarrago, X. ... 70592
+Tarrago, X. ... 70603
+Tartaglia, P. ... 71096
+Tasaki, M. ... 70921
Tashima, M.M.+ ... 72524
+Tasillo-Hirt, A.M. ... 73715
+Tasjukow, F.C. ... 71556
Tassigny, C.de ... *see* de Tassigny, C.
Tatarenko, S.+ ... 72241
+Tatsuzaki, I. ... 72818
+Tauber, R.N. ... 71993
+Taubin, M.L. ... 73208
+Tawfik, A. ... 72534
+Taylor, C. ... 70171
+Taylor, J.G. ... 70197
+Taylor, J.G. ... 70198
+Taylor, J.H. ... 74095
+Taylor, J.R. ... 71154
+Taylor, J.W. ... 70952
Taylor, L.S. ... 73653
Taylor, M.W.+ ... 71146

+Taylor, P. ... 72778
+Taylor, R. ... 70020
Taylor, R.J. ... 73291
+Taylor, R.L. ... 69886
Taylor, R.W.+ ... 73467
+Taylor, S. ... 73024
+Taylor, T.D. ... 69893
+Taylor, W.E. ... 73443
Tazawa, T.+ ... 70574
+Tazuke, S. ... 73383
+Te-Xiu Zhao ... 73371
+Tech, J.L. ... 70815
Tegen, R.+ ... 70348
+Teguri, Y. ... 73406
+Teh, H.C. ... 72072
+Teillet, J. ... 72615
+Tejima, Y. ... 71257
Tekel, L. ... 73402
+Telitsin, V.B. ... 70450
Teller, E. ... 71730
Teller, E. *(ed.)* ... 69800
+Tellinghuisen, J. ... 70837
Temkin, H.+ ... 71118
Tench, D.+ ... 73008
Tendeloo, G.van ... *see* van Tendeloo, G.
+Teng, Y.Y. ... 72880
Tennakone, K.+ ... 72456
Tenne, R.+ ... 73465
Tennyson, J.+ ... 70979
Teodorescu, D. ... 73436
+Teplov, I.B. ... 70530
+Teplov, V.A. ... 71971
Teplyi, M.I. ... 71491
Terada, M.+ ... 71116
+Teramoto, I. ... 71121
Terao, K.+ ... 72650
Terasawa, H.+ ... 71658
+Terekhov, A.N. ... 72902
+Tereshchenko, I.G. ... 73055
+Terrance, A.L.E. ... 73090
+Terreni, S. ... 72200
+Terrien, Y. ... 70753
+Terry, S.C. ... 70051
+Terumichi, Y. ... 71701
+Terzikyan, S.A. ... 70125
Teshukov, V.M. ... 71597
Teslenko, V.V.+ ... 72003
+Tetenyi, P. ... 72938
+Tetervov, A.P. ... 72677
+Teukolsky, S.A. ... 74065
+Thakkar, A.J. ... 70978
+Thamburaj, R. ... 73204
+Thatcher Bordon, W. ... 70791
Thawani, P.T. ... 71268
Thegerstrom, C.+ ... 70659
Theiner, W.A.+ ... 70690
+Theis, T.N. ... 72871
Theis, W.M.+ ... 71983
+Theobald, F. ... 70918
Theocharous, E. ... 71243
Theodosiou, C.E. ... 70764
+Theoharatos, G. ... 73401
+Thibault, C. ... 71030
+Thibault-Desseaux, J. ... 71965
+Thieme, F. ... 72959
+Thierry-Meig, V. ... 72861
+Thijsse, B.J. ... 71902
+Thirer, N.S. ... 71713
+Thirlwell, T. ... 73290
+Thiry, P.A. ... 72248
Tho Nguyen Minh .. *see* Minh Tho Nguyen
+Thodos, G. ... 73418
+Thodos, G. ... 71677
+Thom, R.L. ... 71962
Thomalla, E.+ ... 73889
Thomas, A. ... 73337
+Thomas, A.G. ... 73173
Thomas, A.S.W.+ ... 71538
Thomas, G.A. ... 72357
Thomas, G.F. ... 71098
+Thomas, J.R., Jr. ... 71381
+Thomas, J.R., Jr. ... 71382
+Thomas, L.E. ... 70648
+Thomas, M.F. ... 72604
Thomas, P. ... 74029
+Thomas, P.C. ... 74031
+Thomas, T.D. ... 70948
Thomas, T.J.+ ... 71465
Thommeret, Y.+ ... 73743
Thompson, A.M.+ ... 73872
Thompson, J.M.T. ... 71416
Thompson, L.K. ... 72364
+Thompson, T.W. ... 74011
Thomsen, J.S. ... 69832
+Thomson, B.A. ... 73384
+Thomson, R.E. ... 73818
+Thonnard, N. ... 74148
+Thorn, C.E. ... 70620
Thornton, C.E.+ ... 73182
Thornton, E.B.+ ... 73817
+Thornton, S.T. ... 70561
+Thornton, S.W. ... 71245
Thronson, H.A., Jr.+ . 74131
Thuan Trinh X. ... *see* Trinh X. Thuan
+Thummler, F. ... 73051
+Thummler, F. ... 73039
Tian-xia Song ... *see* Song Tian-xia
Tibarewala, D.N.+ ... 73626
+Tibell, G. ... 70631
+Tichler, J.W. ... 70689
Tie-cheng Li ... *see* Li Tie-cheng
Tie-Han Shen ... *see* Shen Tie-Han
Tiecheng Li .. *see* Li Tiecheng
Tiedje, T.+ ... 72437
+Tien, J.K. ... 73033
+Tien, J.K. ... 73149
+Tien, J.K. ... 73203
+Tierney, E. ... 72975
Tietje, H.+ ... 72071
+Tikhonov, E.A. ... 73333
+Tildesley, D.J. ... 72183
+Tilgner, J. ... 71702
Tillmanns, E.+ ... 71941
+Tilquin, A. ... 70418
+Timofeev, A.V. ... 71766
Timofeev, V.B.+ ... 72324
Timofeev, Yu.A.+ ... 72535
+Timofeev, Yu.M. ... 73951
+Timofeeva, L.N. ... 73211
+Timofeeva, T.P. ... 73895
+Timoshuk, V.S. ... 72301
Tindle, C.T. ... 71292
Ting Ou-Yang ... 73990
Tingjie Chen ... *see* Chen Tingjie
+Tingsanchali, T. ... 71669
Tinh, N.H. ... 72106
+Tinkham, M. ... 72552
+Tip, A. ... 70828
+Tipping, R.H. ... 70868
Tirapegui, E.+ ... 69930
+Tirapegui, E. ... 69992
Tisljar-Lentulis, G.+ ... 73637
Titomir, L.I.+ ... 73559
+Titovets, Yu.F. ... 71973
+Tiwari, M.D. ... 72175
+Tiwari, O.P. ... 74189
Tjapkin, D.+ ... 72486
Tjong, S.C.+ ... 73244
+Tjuflin, Y.S. ... 74004
+Tkach, I.I. ... 70408
+Tkachev, I.I. ... 74193
Tkachov, F.V. ... 70201
Tkachov, F.V. ... 70317
+Tkachov, F.V. ... 70202
+Tkachuk, M.N. ... 72709
+Tkachuk, M.N. ... 72711
+Tlhabologang, B. ... 70112
+Tobin, J.G. ... 72953
+Tobin, J.G. ... 72966
+Tobita, K. ... 73193
Tobschall, P. ... 70074
Todd, P.J.+ ... 73323
+Todorov, P.T. ... 70413
Todorovic, Z.+ ... 70630
+Toei, K. ... 73391
+Toennies, J.P. ... 72921
+Toennies, J.P. ... 72910
+Toesca, S. ... 73246
+Togler, G. ... 70697
+Tohline, J.E. ... 74144
Tohyama, M.+ ... 70519
Toimela, T. ... 70314
+Toivonen, P. ... 70488
+Tokar', L.M. ... 73758
+Tokarev, V.N. ... 73335
+Toke, J. ... 70576
+Tokumaru, Y. ... 72355
Tokumoto, H. ... 70115
Tokumoto, H. ... 70116
+Tolbert, M.A. ... 71163
Toledo, A.Szanto de ... *see* Szanto de Toledo, A.
Toledo Piza, A.F.R.de ... *see* de Toledo Piza, A.F.R.
Tolk, N.+ ... 72251
Tolksdorf, P.+ ... 70727
+Tolmachev, A.I. ... 70958
+Tolmachev, A.I. ... 71167
Tolnai, L.+ ... 72891
+Tolnai, L. ... 72893
+Tolsma, L.D. ... 70451
Tolstoguzov, A.B.+ ... 72934
Tolstoy, I. ... 71287
Tolstoy, I. ... 73809
Tomar, J.S.+ ... 71446
+Tomaras, T. ... 69956
+Tomasello, P. ... 72294
+Tomasi, E. ... 70635
+Tombak, M.A. ... 70751
+Tomilov, S.B. ... 72717
Tomiska, J. ... 72136
+Tomita, Y. ... 71781
Tomlin, J.L.+ ... 72515
Tomlinson, G. ... 70925
+Toneev, V.D. ... 70570
Tong, S.Y.+ ... 72953
Tong, S.Y.+ ... 72966
Tong Cheon, Il. ... 70545
Tong Fang ..... *see* Fang Tong
+Tonwar, S.C. ... 73963
+Topham, D.R. ... 71805
Topp, S.V. *(ed.)* ... 69789
Toppet, S.+ ... 72687
+Torbet, J. ... 73523
+Torii, H. ... 73054
Toro, M.Di .. *see* Di Toro, M.
Toropin, S.I. ... 70034
Torrie, B.H.+ ... 72795
+Torrie, G.M. ... 70008
+Torsani, J.A. ... 73883
+Torto, I. ... 70876
+Torto, I. ... 70877
+Tosheva, M.V. ... 70413
+Tosic, B.S. ... 72312
Tostevin, J.A.+ ... 70556
+Toth, J. ... 72963
Toth, L.+ ... 72282
+Touchard, F. ... 71030
Touchard, G.+ ... 71662
+Toulouse, P. ... 73674
+Towner, I.S. ... 70431
Townes, C.H.+ ... 74135
Townsend, P.K. ... 70196
Townsend, P.K.+ ... 69967
+Townsend, P.K. ... 70215
+Toyoda, K. ... 71977
Toyoda, T.+ ... 72749
+Toyoshima, H. ... 72527
Toyozawa, Y. ... 72316
+Tracas, N.D. ... 70340
Trafton, L.+ ... 74037
+Trajmar, S. ... 71022
Trakhbrot, B.M. ... 72250
+Trakhtenberg, I.Sh. ... 72169
+Trakhtengerts, V.Yu. ... 73959
+Tran, M.D. ... 70351
+Tran, N.H. ... 70827
Tratt, D.M. ... 72737
+Traum, M. ... 72251
+Trautman, V.Yu. ... 70542
+Trautmann, W. ... 70623
+Travnikov, V.S. ... 72419
+Trayanov, R.K. ... 70413
Trebin, H.-R. ... 71918
+Trehan, R. ... 72964
+Treiner, J. ... 70476
+Treleani, D. ... 70331
+Trentadue, L. ... 70398
+Tretyak, O.V. ... 72400
+Treusch, J. ... 72321
Tribel'skii, M.I. ... 73254
+Tribillon, G. ... 71094
Tribollet, B.+ ... 72458
+Tribollet, B. ... 73268
+Triebel, W. ... 70119
+Trifonov, I. ... 72281
+Trilling, G.H. ... 70399
Trimble, V. ... 74116
Trinh X. Thuan ... 74145
+Trinkaus, H. ... 73145
+Triolo, R. ... 73372
+Tripathi, A.N. ... 71015
+Tripiccione, R. ... 70403
+Troegubov, A.I. ... 70048
+Trofimenkoff, F.N. ... 73937
+Trofimov, V.F. ... 71614
+Trofimova, L.N. ... 73085
Trombetti, F.+ ... 73858
Trombik, W+ ... 70623
+Trommasini, F. ... 72200
+Trommel, J. ... 72710
Troshchenko, V.T.+ ... 73209
+Troshin, L.P. ... 70031
+Trotter, J. ... 71953
+Troup, G.J. ... 72666
Trowbridge, E.A. ... 73622
Trowbridge, E.A.+ ... 73623
Troxell, J.R. ... 71996
+Troyan, V.I. ... 72600
+Trozzi, C. ... 69981
+Truc, A. ... 71800
+Truhlik, E. ... 70458
+Trumble, T.M. ... 73443
Truong, T.T.+ ... 70006
+Trzeciakowski, W. ... 72350
+Tsai, C.L. ... 73032
+Tsai Chien-hua ... 72207
+Tsang, J.C. ... 72871
+Tsang, M.B. ... 70604
Tsang, W.T.+ ... 71120
+Tsaparlis, G.R. ... 72596
+Tsaprilov, A.S. ... 72012
+Tsartsidze, M.A. ... 73535
Tschunko, H.F.A. ... 71077
+Tselepidaki, H. ... 73401
+Tselinko, A.M. ... 71169
+Tserklevich, A.L. ... 74032
Tsifrinovich, V.I. ... 72689
+Tsiklauri, G.V. ... 71656
+Tsiovkin, Yu.N. ... 72617
+Tsiporukha, V.D. ... 72750
+Tskhakaya, V.K. ... 72214
Tso-hsiu Ho .. *see* Ho Tso-hsiu
+Tsuchida, J. ... 71555
Tsuchiya, H.+ ... 71831
+Tsuchiya, S. ... 73368
+Tsuchiya, T. ... 71904
Tsujimi, Y.+ ... 72818
+Tsujimoto, Y. ... 72773
Tsujino, T.+ ... 71610
Tsujino, T.+ ... 71611
+Tsujino, T. ... 71609
+Tsujino, T. ... 71612
+Tsujitake, M. ... 70158
Tsukahara, S.+ ... 72646
+Tsukanov, V.G. ... 72869
+Tsukruk, V.V. ... 71878
Tsukuda, Y. ... 73038
Tsunogai, S.+ ... 73876
+Tsupko-Sitnikov, V.M. ... 70427
+Tsupko-Sitnikov, V.M. ... 70485
+Tsurkan, G.I. ... 72455
+Tsutsui, H. ... 73685
+Tsuzuki, T. ... 71781
+Tsvetkov, V.Yu. ... 72630
+Tsyrlin, M.B. ... 72632
+Tsytovich, V.N. ... 71714
Tu Xiang-zhong ... 71961
Tu-nan Ruan ... *see* Ruan Tu-nan
+Tubis, A. ... 73585
Tucholke, B.E.+ ... 73763
+Tucker, R.W. ... 70259
Tugov, I.I.+ ... 70841
+Tugushi, A.I. ... 72704
+Tuli, S.K. ... 70589
+Tullini, F. ... 70765
+Tully, J.C. ... 72913
+Tul'skii, S.V. ... 73555
Tung, R.T.+ ... 72992
Tuohy, I.R.+ ... 74180
+Tuomi, T. ... 72014
+Turbaev, V.V. ... 72010
Turcotte, D.L.+ ... 73798
+Turcotte, D.L. ... 74014
+Turek, K. ... 70749
+Turkner, K.-H. ... 70084
+Turl, C.W. ... 73593
+Turna, L'. ... 69909
+Turna, L'. ... 71647
+Turnbull, D. ... 72081
Turner, M.J. ... 71668
Turner, M.S.+ ... 74194
Turner, R.C. ... 69845
+Turner, R.J. ... 72515
+Turolla, R. ... 69973
+Tusheva, L.A. ... 69890
+Tutov, A.G. ... 70671
+Tverdokhleb, I.G. ... 70161
+Tveten, A.B. ... 71250
+Tvrdy, M. ... 69863
+Twin, P.J. ... 70442
Tyagi, M.S.+ ... 72415
+Tyakht, V.V. ... 70845
+Tzach, D. ... 71748
+Tzeng, W.-B. ... 70961

+Uchida, K. ... 73065
+Uchida, Y. ... 73191
Uchiki, H.+ ... 71164
+Uda, H. ... 73437
+Ueha, S. ... 71297
+Ueno, H. ... 70753
+Uglov, A.A. ... 71160
Uhlhorn, C.D.+ ... 70577
+Uhlmann, A. ... 69919
+Uhrhammer, R.A. ... 73749
+Ui Fei Zhang ... 71432
Uitert, B.Van ... *see* Van Uitert, B.
Ujihara, K. ... 71197
Ukigai, M.+ ... 71278
+Ulbrich, R.G. ... 72321
+Ulmer, M.P. ... 74161
Ulrich, R. ... 71244
Ulvestad, J.S.+ ... 74147
Umarji, A.M.+ ... 72636
Umebayashi, T. ... 74137
Umemura, T.+ ... 72692
+Umeya, K. ... 73619
Umland, E.+ ... 70462
+Umnov, A.F. ... 71204
Unkefer, C.J.+ ... 70903
Unruh, W.G.+ ... 69951
+Unwin, S.C. ... 74176
Uosaki, K.+ ... 72492
+Ura, K. ... 70156
+Ura, K. ... 70158
Uramoto, J. ... 73001
+Uranishi, K. ... 71616
+Urata, T. ... 74051
+Urban, S. ... 70854
+Urban, W. ... 70983
+Urbaniak-Kucharczyk, A. ... 72643
+Urli, N.B. ... 73414
+Uryu, N. ... 72682
+Ushenko, A.G. ... 71095
Usher, P.D.+ ... 74175
+Ushita, T. ... 73685
+Uskov, A.V. ... 72869
+Uspenskii, V.S. ... 72401
+Ustichenko, V.A. ... 72177
+Ustinov, N.D. ... 71204
+Usui, S. ... 72005
+Utiyama, H. ... 69998
+Utracki, L.A. ... 73206
+Uzakov, A.A. ... 72135
+Uzhinov, B.M. ... 71111
+Uzureau, J. ... 70635

+Vaatstra, W. ... 71561
+Vaccaro, R. ... 69981
Vacher, R.+ ... 72062
+Vacher, R. ... 72822
+Vacher, R. ... 72821
+Vacher, R. ... 71913
+Vaclavik, J. ... 71728
Vagin, B.A.+ ... 70049
+Vagnetti, F. ... 74174
+Vagradov, G.M. ... 70540
+Vaidya, A.N. ... 69945
+Vainshtein, D.I. ... 70091
+Vaishnene, L.A. ... 70633
Vaissiere, C.de la ... *see* de la Vaissiere, C.
Vakilova, G.+ ... 72001
Valakh, M.Ya.+ ... 72314
+Valbusa, U. ... 72200
Valdmanis, J.A.+ ... 71226
+Valentian, D. ... 70146
+Valentin, J. ... 70418
Valentini, H.-B. ... 71814
Valera, J.de ... *see* de Valera, J.
+Vales, N. ... 74010
Valiev, R.Z.+ ... 71972
+Vallee, G. ... 72614
+Vallet-Regi, M. ... 72254
Valley, G.C.+ ... 71194
Valley, V.+ ... 73556
Valsakumar, M.C.+ ... 70068
Valsakumar, M.C.+ ... 69986
+Valsakumar, M.C. ... 71404
+van Albada, G.D. ... 74093
+van Apeldoorn, G.W. ... 70368
+Van Art, R.L. ... 72259
van Bers, W.A.M.+ ... 71222
+van Buren, D. ... 74106
+van Dam, H. ... 70200
+van Dam, P. ... 70368
+van Damme, H. ... 72851
+van den Beukel, A. ... 71902
+Van den Bosch, A. ... 72575
Van den Broeck, C.+ . 73375
+van der Hulst, J.M. . 74093
+van der Merwe, A.J. ... 70454
van der Merwe, J.H.+ ... 70454
+Van der Velden, G. ... 72687
+Van Dop, H. *(ed.)* ... 69793
+van Driel, J. ... 70591
+Van Driel, M.A. ... 70414
+van Heijst, G.J.F. ... 71566
+Van Horn, H.M. ... 74099
+Van Hove, M.A. ... 72205
Van Hoven, G.+ ... 73983
+van Isacker, P. ... 70433
+van Landuyt, J. ... 73090
van Langeveld, A.D.+ ... 72201
+van Loo, F. ... 73111
+van Nieuwenhuizen, P. ... 69967
+van Opdorp, C. ... 72481
+Van Overstraeten, R. ... 73449
+Van Overstraeten, R. ... 73444
+Van Overstraeten, R. ... 72415
+van Ruyven, L.J. ... 71126
+van Tendeloo, G. ... 73090
+Van Uitert, B. ... 70414
+van Veen, A. ... 71960
Van Vui Pham ... *see* Pham Van Vui
Van Woert, M. ... 73819
van Wunnik, J.N.M.+ ... 72919
+Vancu, A. ... 72786
+VanDalen, G. ... 70585
Vandenborre, M.T.+ ... 72792
Vander Sande, J.B. ... 71847
+Vanderhaghen, R. ... 70418
+Vanderwal, J.J. ... 72072
+Vansummeren, J. ... 72575
+Varadan, V.K. ... 71442
+Varadan, V.K. ... 71443

+Varadan, V.V. 71442
+Varadan, V.V. 71443
Vardapetyan, R.R.+ 70125
+Vardelle, A. 71692
Vardelle, M.+ 71692
+Vardevanyan, P.O. 70125
Varentsov, O.K. 71660
+Varga, J.C. 70601
Varga, P.+ 72931
+Varghese, S.L. 71007
+Varlakov, V.P. 71924
Varley, E.+ 71587
+Varnell, W.D. 72799
+Varoquaux, E. 72178
+Varret, F. 72615
+Varshavskaya, O.A. 73515
+Vasavada, K.V. 70907
+Vasenin, I.M. 71614
Vashishta, P.+ 72086
+Vashishta, P. *(ed.)* 69788
Vashista, P.+ 72083
Vasil'ev, M.A.+ 72889
+Vasil'ev, P.P. 71137
Vasil'ev, S.S.+ 70525
+Vasil'ev, V.V. 71505
Vasil'eva, M.A.+ 71208
+Vasil'eva, V.B. 73086
+Vasilevskaya, L.V. 72645
+Vasilishcheva, I.V. 71233
+Vasquez, M.C. 70872
Vassallo, C. 71230
Vasudev, P.K.+ 72000
Vasudevan, R.+ 73188
Vatazhin, A.B.+ 71631
Vatnitskij, S.M.+ 73665
Vaucouleurs, G.de *see* de Vaucouleurs, G.
+Vaughan, M.T. 73792
+Vaughan, R.W. 72690
Vavilov, V.S.+ 72882
+Vavilov, V.S. 72512
+Vayaki, A. 70307
+Vaz, L. 70595
Vaz, L.C.+ 70578
+Vazdyk, Ya.A. 70413
+Vdovin, A.N. 70426
+Veall, N. 73660
+Vebrel, J. 70918
Vecchia, P.Di *see* Di Vecchia, P.
Vecchio, G.Lo *see* Lo Vecchio, G.
Vedel, J.+ 73439
Vedeneev, A.A.+ 71105
Vedenov, A.A.+ 71821
Veen, A.van *see* van Veen, A.
+Veenhuizen, H. 70951
Veerabhadra Rao, P.+ 73228
Vega, H.J.de *see* de Vega, H.J.
Veit, I. 71325
Veith, G.+ 71123
+Veith, H. 70696
+Vejmelka, P. 70679
+Vekilov, Yu.Kh. 72459
+Veksler, V.I. 72873
Velden, G.Van der *see* Van der Velden, G.
+Veliev, E.I. 69897
Velinov, P.I.+ 73954
+Veltri, P. 73957
Veneziano, G. 70258
+Venkata Ramaniah, K. 70451
Venkatachalappa, M.+ 73760
+Venkatakrishna Iyer, S. 73284
Venkatasiva Murthy, K.N. 71661
Venkateswara Rao, G.+ 71413
+Venkateswara Rao, G. 71445
Venkateswara Sarma, K. 71450
+Venkatewasara Rao, G. 71431
Vennemann, N.+ 72233
Venzke, D.+ 70835
+Verbeken, M. 70408
+Verbist, J.J. 72248
Verdier, P.+ 71901
Verdugo, P.+ 73517
+Vereshchaka, V.M. 72906
Vergazov, A.N.+ 71973
+Verges, J. 70983
+Vergnes, M. 70435
Verkhoturov, A.D.+ 73028
+Verkhovskii, S.V. 72681
+Verma, A.L. 72841
Vermeer, P.A.+ 71402
+Verner, V.D. 72459
+Verrillo, R.T. 73609
+Versmold, H. 70881
+Vertse, T. 70456
+Vervoort, J. 70887
+Ves, S. 72363
Vette, G.M.C.De *see* De Vette, G.M.C.
Veverka, A. 71817
+Veverka, J. 74031
+Veyre, A. 73652
+Vialaret, G. 73458
+Viallet, C.M. 72572
Vian, J.-P.+ 71303
+Viccaro, P.J. 72636
+Victory, H.D., Jr. 70022
+Vidal, B. 70769
+Vidal-Madjar, D. 73861
+Vidalko, E.I. 72429
+Videbaek, F. 70620
+Vidmar, P.J. 71291
+Viehbock, F.P. 72467
+Vieira, J. 73021
+Vielhaber, W. 72226
+Viesti, G. 70744
Vigdergauz, S.B. 69880
+Vigier, J.P. 69917
+Vignaud, D. 70368
+Vignaud, D. 70307
Vigroux, L. 73992
Vikhnin, V.S. 72672
Vikhor, L.N.+ 72428
Villa, I.M.+ 74057
Villante, U.+ 73965
+Villarreal, P. 70966
+Villarreal, P. 70992
Villeneuve, D.de *see* de Villeneuve, D.
Villeneuve, D.M.+ 71763
Vina, L.+ 72754
+Vinas, X. 70477
Viner, J.M.+ 72108
+Vinetskii, V.L. 72417
+Vingyalis, L.L. 72500
+Vinh Mau 70404
+Vinogradov, B.V. 72535
+Vinogradov, E.A. 72878
Vinogradov, G.A.+ 73027
+Vinogradova, M.N. 72352
Vinokurov, E.A.+ 70739
Vinokurov, L.I.+ 70019
+Vinoradov, A.S. 70899
+Viola, V.E., Jr. 70609
+Violante, V. 69981
+Viot, P. 71690
Virchenko, Yu.P. 70018
+Virkar, A.V. 73043
Virlet, J.+ 72694
Vishnev, I.P.+ 71634
Vishnevskii, I.I.+ 73156
+Vishnevskii, Ye.S. 73543
Vishnyakov, N.A.+ 73307
+Vishtak, A.P. 71452
+Viskanta, R. 71341
Visoven, O.S.+ 71435
+Visser, C. 70368
Viswamitra, M.A.+ 73519
Viswanadham, Y.+ 73883
+Viswanath, P.R. 73963
Viswanathan, K.S.+ 70837
+Viswanathan, K.S. 70287
+Vita-Finzi, C. 73743
Vitebskii, I.M. 72100
Vitebskii, I.M.+ 72688
+Vitiello, G. 70199
+Vitman, R.F. 72001
+Vlasak, P. 71648
Vlasenko, L.S. 72702
+Vlasenko, L.S. 72700
+Vlasenko, L.S. 72701
+Vlasenko, L.S. 72703
+Vlasenko, N.V. 72273
+Vlaskov, V.A. 73954
Vlasov, A.A. 74117
+Vlassopulos, S.D.P. 70340
+Vobornik, S. 70811
Vodop'yanov, K.L.+ 71143
+Vogel, F.L. 72561
+Vogel, O. 70823
+Vogel, W. 71888
+Vogrinetz, J. 73484
+Vohringer, O. 73129
Voigtman, E.+ 70964
Voinich, E.V.+ 70031
Voinov, O.V. 71578
Voitenko, A.F.+ 73127
+Voitlander, J. 72691
Voitovich, L.N. 71621
+Vojtik, J. 70980
+Vokal, S. 70588
+Vokal, S. 70537
Volbert, B. 70157
+Volchok, O.I. 71967
Volkel, M.+ 70153
+Volkenshtein, N.V. 72617
+Volkov, A.Yu. 71105
Volkov, V.S. 71507
Volkov, Ye.I. 73544
+Volnin, E.N. 70552
Vologzhaninov, Yu.I.+ 71506
Volokitin, G.I. 71409
Voloshina, A.L.+ 72760
+Volyak, K.T. 71285
+Von Damm, K. 73765
+von der Osten, W. 72863
+von Goeler, S. 71729
+von Hippel, F. 73411
von Oertzen, W.+ 70438
+von Oppen, G. 71033
+von Schickfus, M. 72071
Voorhees, P.W.+ 72128
Vorlicek, V.+ 72801
+Vorobyov, A.A. 70552
+Vorobyov, A.A. 70408
+Voronin, A.I. 69915
+Voronin, V.B. 71795
Voronkova, V.K.+ 72668
+Voronova, L.I. 73219
+Vorontsovskii, A.V. 70502
Vorotyntsev, V.V.+ 71406
Vorozhtsov, E.V.+ 69892
Vos, R.J.de *see* de Vos, R.J.
+Voss, B. 70695
+Vovk, A.B. 70483
Vovnenko, V.I.+ 72848
+Vozniakova, B. 72146
+Vrbancich, J. 72797
+Vrbik, J. 71475
Vries, M.S.de *see* de Vries, M.S.
Vu, B.Q.+ 71479
Vui Pham Van *see* Pham Van Vui
+Vujcich, M. 73840
+Vuori, S. 70684
Vuskovic, L.+ 71022
+Vyacheslavov, L.N. 71753
Vylov, Ts.+ 70500

Waard, H.de *see* de Waard, H.
+Wachnik, R.A. 72561
+Wachsmuth, H. 70307
Wada, M.+ 71121
+Wada, M. 72789
Wada, T.+ 73480
+Wada, W.W. 70262
Wada, Y.+ 72498
+Wadati, M. 72574
+Wade, C.A. 71245
+Wade, C.M. 74039
Wadman, W.J.+ 73558
Wagner, C.N.J.+ 71865
+Wagner, C.N.J. 71839
+Wagner, D.K. 71223
Wagner, J.+ 72319
+Wagner, J. 71253
+Wagner, J. 72322
+Wagner, J.B., Jr. 73358
+Wagner, W.R. 71118
+Wahab, M.A. 71294
+Wahlich, R. 73093
+Wait, G.D. 70539
+Wakamura, K. 72802
Wakasugi, K.+ 73946
Wakil, S.A.El *see* El Wakil, S.A.
+Wakimoto, T. 73391
+Walawender, W.P. 71629
Walczak, A. 70155
+Wald, R.M. 69951
+Walecka, J.D. 70544
+Walkade, N.S. 73407
Walkden, M.W.+ 73440
+Walker, B.E. 71567
+Walker, D.H. 73441
Walker, I.W. 73971
Walker, I.W.+ 73975
Walker, R.B.+ 73328
+Walker, R.C. 74176
Walker, R.L. 74085
Walker, R.L. 74086
Walker, R.L.+ 74111
+Walker, S. 72734
+Walker, S. 72731
+Wallace, D.J. 70011
Wallace, J.S.+ 73400
+Wallace, S.J. 70549
+Wallace, S.J. 70550
+Wallace, W.E. 72641
+Wallach, E.R. 73182
+Walls, F.L. 70039
+Wallura, E. 72165
+Wallwork, S.C. 72394
+Walmsley, D.G. 72515
Walmsley, H.L. 71513
+Walsh, D. 72850
Walsh, F.C. 73343
Walsh, M.J. 71530
Walte, F.+ 73298
Walter, F.M.+ 74107
+Walter, J. 73078
+Waltham, C.E. 70539
Walton, D.+ 72072
Walton, J.P.R.B.+ 72183
+Wamsteker, W. 74047
Wan Kay-Kong *see* Kay-Kong Wan
Wan-ji Chen *see* Chen Wan-ji
+Wan-Lee Yin 71521
+Wang, J.-I. 72799
Wang, J.L.+ 72545
+Wang, J.N. 71470
+Wang, J.S. 73146
Wang, S.C.S.+ 73342
+Wang, X.Z. 72938
Wang, Y.F.+ 73476
Wang, Z.Z.+ 72379
+Wang Chang-heng 73434
+Wang Chao-guo 72528
+Wang Chongye 71028
+Wang Chongye 71031
Wang Da-jun+ 71427
Wang De-ning+ 71988
Wang Ji-zhong+ 71087
Wang Jia-Zhu *see* Jia-Zhu Wang
+Wang Liang-yu 72105
+Wang Lijun 71745
+Wang Ming-yi 71952
+Wang Shou-zheng 72528
+Wang Wei-wei 69937
Wang Xushi *see* Xushi Wang
+Wang Yinde 71028
+Wang Yinde 71031
+Wang Yun-yu 72883
Wang Zhen-ming 73119
+Wanklyn, B.M. 72385
Wannier, P.G.+ 74126
Warburton, A.E.A. 69914
+Ward, C.A. 73400
+Ward, D.R. 70405
+Ward, I.M. 73181
+Ward, L. 70823
+Warhaft, Z. 71527
+Warmack, R.J. 73323
Warnecke, E.+ 70682
+Warnock, A., III 74175
+Warren, L.F. 73008
Warren, W.W., Jr.+ 72395
Warwick, A.I.+ 70517
+Warwick, M.E. 73280
+Wasa, K. 72770
Wasilewski, Z.+ 72347
Wasim, S.M.+ 72176
+Wasserburg, G.J. 73940
+Wasserburg, G.J. 74057
+Wasserman, I. 74186
Watanabe, A.+ 71152
+Watanabe, A. 73065
Watanabe, H.+ 72266
+Watanabe, M. 72840
+Watanabe, N. 72949
+Watanabe, O. 73194
+Watanabe, S. 73960
Watanabe, T. 73197
Watanabe, T.+ 72780
+Watanabe, T. 73002
Watanabe, Y. 69899
Watkins, D.E.+ 71199
Watkins, G.D. 72346
+Watkins, W.E. 73869
+Watson, D.M. 74135
+Watson, J.W. 70601
+Watson, P.A. 73904
Watson, P.K. 72736
+Watson, W.D. 73982
+Wattal, P.K. 70669
+Watts, A. 73512
Watts, D.R.+ 73816
Watts, R.N.+ 70814
Wayne, S.F.+ 73223
Weaver, H.T.+ 73448
Webb, J.G.K.+ 70900
+Webb, M.A. 73524
Webb, R.P.+ 72020
+Webb, S.P. 71163
+Webber, H.C. 72006
+Webbink, R.F. 74151
+Weber, H.H. 72836
Weber, J.+ 70772
+Weber, R.L. 69808
+Weber, T.A. 71683
+Weber, W. 72885
+Webman, I. 72368
+Webster, P.J. 72610
+Webster, P.J. 72611
+Wecker, C. 72805
+Weeks, R.A. 72158
+Weertman, J. 71962
+Weertman, J.R. 73200
+Weger, M. 72541
+Wegner, D. 70577
Wehner, M.F.+ 69999
+Wei, M.S. 73070
Wei-bao Zhang *see* Zhang Wei-bao
Wei-wei Wang *see* Wang Wei-wei
Wei-yi Jia *see* Jia Wei-yi
Wei-yuan Wnag *see* Wnag Wei-yuan
Wei-yue Zhang *see* Zhang Wei-yue
+Weidenmuller, H.A. 70534
Weidner, D.J.+ 73792
+Weik, F. 70517
+Weill, A. 73861
+Weill, A. 73857
Weimer, R.J.+ 73777
+Weinbaum, S. 71637
+Weinberg, N.L. 73810
+Weinberg, S. 69968
Weingartshofer, A.+ 71013
+Weinhardt, N. 71155
+Weinstein, A. 70186
Weintraub, R.+ 72122
+Weis, J.J. 72432
+Weisbin, C.R. 73396
+Weise, W. 70348
+Weiss, A. 71940
+Weiss, G. 72545
Weisskopf, M.C.+ 74096
+Weisz, S. 70418
Weitz, D.A.+ 72784
Welberry, T.R.+ 71970
Welch, R.+ 73949
Welin, G. 74083
Weller, C.S. 74183
+Wells, J. 70307
+Wells, J.C. 70441
+Wells, J.C. 70597
Wells, R.L.+ 73640
+Wells, R.P. 73168
Welsch, G.+ 73152
+Welsh, R.E. 71041
Wen Zhang *see* Zhang Wen
Wen-Gui Lin *see* Lin Wen-Gui
Wen-qing Shen *see* Shen Wen-qing
Wen-zhi Zhang *see* Zhang Wen-zhi
Wen-zhou Wu *see* Wu Wen-zhou
Weng, G.J. 72034
Weng, G.J. 73122
Wenqi Zhang *see* Zhang Wenqi
+Wenzel, E. 73597
+Werme, L. 70701
+Werner, A. 72606
+Werner, J.S. 73577
+Werth, G. 71032
+Wertheim, M.S. 71855
Wesely, M.L.+ 73873
+Wesemael, F. 74081
+Wesener, J.R. 70911
Wesner, D.+ 72967
Wesson, P.S. 74163
West, B.J.+ 69987
+West, P. 70169
+West, P.C. 69966
Westbury, J.R. 73605
+Westerfeldt, C.R. 70528
Westermann-Clark, G.B.+ 72172
Western, L.R.+ 73982
+Westfall, G.D. 70604
+Westfall, G.D. 70601
Westphal, D.+ 72957
Wetzel, J.T.+ 71976
+Weyant, J.P. 73397
+Weymann, R. 74046
+Whaley, K.B. 72224
+Whaley, T.W. 70903
+Whang, S. 73032
+Wheeler, B. 73421
+Wheeler, J.A. 69813
+Whelan, J.M. 72265
Wherrett, B.S.+ 71189
Whicker, F.W. 73502
+Whinnery, J.R. 71153
+White, B.R. 74030
White, C.L.+ 73198
White, J.S.+ 73603
+White, N.E. 74103
White, N.M.+ 73141
+White, T.O. 70405
+White, W.D. 71700
Whitehead, L.A.+ 69824
+Whitenton, J.B. 70315
Whitford-Stark, J.L. 74017
+Whitmore, J. 70405
Whittington, S.G.+ 70008
+Whittle, D.P. 72166
Whyte, J.R., Jr.+ 70082
Wi-tze Huang *see* Huang Wi-tze
Wichman, I.S. 71663
+Widom, A. 70183
+Wiedemeier, H. 72975
Wiedmann, U. 73395
+Wiegmann, W. 72769
Wieliczka, D. 72968
+Wieling, N. 73286
+Wieman, C.E. 70814
+Wieman, H.H. 70517
+Wiese, P. 71803
+Wiesenfeld, J.R. 73356

+Wieser, H. 70857
+Wiess, J.A. 71593
+Wiffen, F.W. 72018
Wight, C.A.+ 70995
+Wigmans, R. 70368
Wigmore, J.K.+ 70112
+Wignall, G.D. 71909
+Wijewardhana, L.C.R. 70171
+Wijewardhana, L.C.R. 70255
Wikswo, J.P., Jr.+ 73694
+Wilcke, W. 70609
+Wilcox, W. 70312
Wilczek, F. 70270
+Wilczek, F. 74194
+Wilczynski, J. 70591
+Wilczynski, J. 70518
+Wild, N. 71699
+Wild, P. 74093
+Wild, R.K. 70650
+Wild, W.J. 69822
+Wilding, M.J. 73178
+Wilets, L. 70354
+Wilheim, J. 71813
+Wilhelmi, B. 70119
+Wilhelmi, B. 71151
+Wilk, I. 70107
+Wilkins, B.D. 70517
+Wilkins, H.A. 73660
+Wilkinson, G.R. 72798
+Wilkinson, J.R. 70056
+Will, T.A. 72549
Willemann, R.J.+ 74014
+Willemann, R.J. 73798
+Williams, A. 73644
+Williams, D.R. 71962
Williams, E.G. 71275
+Williams, G.A. 72178
Williams, G.P.+ 72951
+Williams, G.P. 72952
Williams, I.+ 73719
+Williams, J.A. 73136
Williams, J.F. 70127
+Williams, R.J. 73786
Williams, R.K.+ 72018
+Williams, R.M. 73873
+Williams, S.H. 74030
Williams, T.J.+ 73378
Williamson, A.S. 70662
+Williamson, B.E. 71970
+Williamson, C.F. 70449
+Willis, R.F. 72199
+Willson, J.P. 71247
Wilschut, H.W.+ 70518
+Wilson, A.J. 73672
+Wilson, A.S. 74147
Wilson, B.A.+ 72859
+Wilson, F.L. 70054
+Wilson, G.N. 73588
+Wilson, H.R. 73576
+Wilson, J.A. 73239
+Wilson, J.A. 72305
+Wilson, J.D. 73991
Wilson, J.H. 71309
+Wilson, L. 74022
Wilson, N. 71054
+Wilson, R. 70033
+Wilson, R.G. 72000
Wilson, S.D.R.+ 71580
+Wilson, S.R. 71994
Wilson, W.K. 71500
+Winchester, J.W. 73498
Wind, R.A.+ 72710
Windhorn, T.H.+ 72404
+Winefordner, J.D. 70964
Winfree, A.T. 73560
Wing Kam Liu+ 71432
Winkelmann, G.+ 71702
+Winkler, C. 73646
+Winkler, R. 71813
Winkler, R.B.+ 71813
Winn, C.B.+ 73478
+Winn, R.C. 73478
+Winston, R. 73424
+Winter, H. 72931
+Winzer, K. 72671
Wirth, A.+ 74146
+Wirth, G. 70612
+Wirth, J.F. 69815
+Wise, M.B. 70345
+Wisegarver, D. 73815
Wisniewski, J.+ 73496
Wit, B.de *see* de Wit, B.
Wit, H.J.de *see* de Wit, H.J.
Withbroe, G.L. 74059
Witherell, M.S. 70498
+Witherspoon, P.A. 73846
Witos, F. 71260
+Witt, A.N. 74132
Witt, T.J.+ 70077
+Wittig, C. 70962
+Wlosinski, W.W. 73304
+Wnag Wei-yuan 71988
Wnuk, M.P.+ 71468
Woert, M.Van *see* Van Woert, M.
+Wogman, N.A. 70497
+Wohlfahrt, H.D. 70489
+Wohlfarth, D. 70455
+Wohlfarth, E.P. 72637
Wojciechowski, K.F. 72494
Wojciechowski, S. 69870
+Wojnar, A. 71279
Wojtczak, L.+ 72643
+Wolf, E. 71190
+Wolf, H. 70727
+Wolf, K.L. 70609
Wolf, M. 73447
Wolfe, J.P. 72323
+Wolfe, W.L. 72744
+Wolfer, W.G. 69999
+Wolff, U. 70212
+Wolfli, W. 71000
+Wolfson, M.G. 70072
+Wollersheim, H.J. 70576
Wolpert, H.D. 71209
+Wolschin, G. 70512
+Wolski, R. 70575
+Wolstencroft, R.D. 74179
+Wolter, H.H. 70577
Won, D.Y.+ 73110
+Wong, J. 71891
+Wong, M. 71039
+Wood, C.A. 74021
+Wood, C.J. 70729
Wood, G.J.+ 71980
+Woods, J. 73004
+Woolfrey, J.L. 70681
+Wooten, B.R. 73577
Wootten, A.+ 74129
Wootton, R. 73505
+Worley, J.F., III 73539
+Wormhoudt, J. 73495
+Wornom, D.E. 73494
Worrall, D.M.+ 74181
Worthington, C.R.+ 73562
Wortis, M.+ 72252
+Wortman, D.E. 71132
+Woussen, GF. 73714
+Wright, C.J. 71939
+Wright, S. 71170
+Wrigley, J.M. 70716
Wu, C-C.+ 74134
Wu, C.Y.R.+ 70953
Wu, T.B.+ 73091
+Wu Cai-ming 71129
Wu Chien-Shiung *see* Chien-Shiung Wu
Wu Guanghan+ 70559
Wu Gun-hung+ 72883
Wu Hua-mo+ 69896
+Wu Jin 71870
Wu Jin *see* Jin Wu
Wu Li-jing 71026
+Wu Nai-Qiang 71870
+Wu Nian-Zu 70951
Wu Qian-feng *see* Qian-feng Wu
Wu Wen-zhou+ 73610
Wuensche, P.+ 73347
+Wuilleumier, F. 70829
Wunnik, J.N.M.van *see* van Wunnik, J.N.M.
+Wunsch, B. 70307
+Wurm, J.P. 70575
Wurrey, C.J.+ 70885
+Wybourne, B.G. 70252
+Wyler, D. 69964
+Wysokinski, L. 73723

X. Thuan Trinh *see* Trinh X. Thuan
Xia Meng-fen 71693
Xia-ti Zhang *see* Zhang Xia-ti
Xian-tu He *see* He Xian-tu
Xiang-ting Li *see* Li Xiang-ting
Xiang-zhong Tu *see* Tu Xiang-zhong
Xiangtao He *see* He Xiangtao
Xianjian Zhou *see* Zhou Xianjian
+Xiao Jia-ning 72745
Xiao-liang Huang *see* Huang Xiao-liang
Xiao-qian Zhou *see* Zhou Xiao-qian
Xiao-wen Cao *see* Cao Xiao-wen
+Xie Kan 73434
+Xie Kan 73361
+Xie Qin-xi 72976
Xin Mi *see* Mi Xin
Xing-chang Song *see* Song Xing-chang
Xiong Guang-Cheng+ 72530
+Xu Yi-sun 72359
+Xu Yuguang 71745
Xu Zhizhan+ 71745
+Xue Peiyou 70292
+Xue Zen Nan 73684
Xue-hui Liu *see* Liu Xue-hui
Xue-xian Chen *see* Chen Xue-xian
+Xushi Wang 73230

+Yabe, M. 72749
+Yablokov, Yu.V. 72668
Yadav, R.B. 71923
+Yagasaki, A. 73557
+Yagawa, G. 70644
+Yagi, T. 72818
+Yagihara, S. 70085
+Yagubskii, E.B. 72381
+Yagushkin, N.I. 70081
Yahata, H. 71571
Yaji, T.+ 71257
Yajima, N. 69901
Yakimov, S.S.+ 73520
Yakinthos, J.K.+ 72588
+Yakobchuk, L.M. 72177
+Yakovenko, V.M. 72338
+Yakovlev, E.N. 72535
+Yakovlev, V.A. 72878
+Yakovlev, V.P. 70547
+Yakovlev, V.V. 70060
+Yakovleva, L.V. 71514
Yakovlyuk, A.+ 72036
+Yakubov, M.S. 70406
+Yakubovich, S.D. 71127
+Yakubtsov, O.A. 72889
+Yamada, H. 70597
Yamada, M. 70365
Yamada, T.+ 73052
Yamagishi, H. 70303
Yamaguchi, H.+ 70846
+Yamaguchi, N. 71762
+Yamaguchi, T. 72830
Yamaguchi, Y.+ 70000
Yamaji, K. 72531
Yamaji, S.+ 70613
+Yamaji, S. 70519
Yamamoto, H.+ 72991
+Yamamoto, K. 70016
+Yamamoto, M. 70782
+Yamamoto, R. 73480
Yamamoto, T. 73811
+Yamamura, M. 70467
+Yamanaka, S. 72559
Yamane, M.+ 72824
Yamanishi, N.+ 70626
+Yamasaki, S. 72355
Yamashiro, M.+ 73303
+Yamashita, E. 73294
+Yamashita, J. 73513
Yamashita, K.+ 72445
Yamawaki, M.+ 72095
Yamazaki, M. 69943
+Yamkovoi, A.I. 71452
+Yamura, K. 73192
Yan Bai-ling 70510
Yan-Zhu Liu *see* Liu Yan-Zhu
+Yanagihara, N. 73487
+Yanagihara, N. 72780
+Yanchuk, Z.Z. 72814
Yanenko, N.N.+ 69890
+Yanenko, N.N. 69892
+Yang, C.Y. 72444
Yang, J.N.+ 73170
+Yang, S. 71231
+Yang, T.Y. 71429
+Yang Dailun 70559
Yang Sung-Kil *see* Sung-Kil Yang
Yang-guo Li *see* Li Yang-guo
Yang-zhung Zhang *see* Zhang Yang-zhung
+Yangui, B. 71974
+Yaniv, A.E. 73245
+Yannoni, C.S. 70092
+Yano, T. 71329
+Yanovsky, A.B. 71708
+Yanus, J.F. 72447
Yao, T.+ 73114
Yao-min Di *see* Di Yao-min
Yapp, C.J. 73882
+Yariv, A. 71119
+Yarmolenko, V.V. 73528
+Yarmolyuk, Ya.P. 72633
+Yarygin, V.I. 72214
Yaseen, R.Salih *see* Salih Yaseen, R.
Yasi Jiang *see* Jiang Yasi
+Yask'ko, A.A. 72214
+Yasuda, E. 73056
+Yasuda, K. 73346
+Yasumoto, M. 72095
+Yasuno, Y. 73667
+Yata, A. 73125
Yata, J.+ 72173
+Yatchenko, I.N. 71709
+Yathindra, N. 73518
+Yatsenko, A.A. 72593
+Yatsenko, L.P. 71169
+Yatsui, K. 71727
Yatsuzuka, M.+ 71727
+Yatsyk, B.N. 72888
Yau-wen Ma *see* Ma Yau-wen
Yavari, A.R. 71899
+Yavokhin, A.N. 71821
Yee Fu-Goul *see* Fu-Goul Yee
+Yeh, Y.Y. 70885
Yeh Yuh-gong 71425
+Yelton, J.M. 70399
+Yen, R. 71148
Yen, S.+ 70449
+Yen, W.M. 72310
Yen Huang *see* Huang Yen
+Yeo, Y.K. 71994
+Yeow, Y.L. 73060
+Yeshurun, Y. 72602
+Yi Sun-Sheng 72638
Yi Zhang *see* Zhang Yi
Yi-Cheng Zhang *see* Zhang Yi-Cheng
Yi-Heng Chen *see* Chen Yi-Heng
Yi-sen Huang *see* Huang Yi-sen
Yi-sun Xu *see* Xu Yi-sun
Yi-Zhou Chen *see* Chen Yi-Zhou
Yin, C.D.+ 71894
+Yin Dao-Le 72530
Yin Wan-Lee *see* Wan-Lee Yin
Yin-sheng Ling *see* Ling Yin-sheng
Yinde Wang *see* Wang Yinde
Ying-Nan Chiu 70770
Ying-Nan Chiu 71911
+Yocum, C.F. 73532
+Yodh, G.B. 73963
+Yokoi, K. 73686
+Yokoshima, I. 70089
Yokotsuka, T.+ 72499
+Yokoyama, I. 71797
+Yokoyama, M. 71727
Yoneyama, M.+ 71328
Yong-hua Lin *see* Lin Yong-hua
Yong-Hyun Paek+ 72164
Yong-kai Huang *see* Huang Yong-kai
Yong-nian Huang *see* Huang Yong-nian
Yong-zhen Liu *see* Liu Yong-zhen
Yontack Chung+ 71684
Yoo, M.H.+ 73145
+Yoon, D.N. 73139
Yoon, H.K.+ 73139
Yoon, H.S.+ 73625
Yoon Young Ku *see* Young Ku Yoon
York, B.R.+ 71945
+Yoshida, S. 70613
+Yoshida, T. 69988
Yoshida, Y.+ 72138
+Yoshida, Y. 73685
Yoshioka, Y.+ 70915
+Yoshizawa, M. 71164
You-xiang Zhao *see* Zhao You-xiang
Young, A.+ 74106
+Young, D.G. 71836
+Young, G.R. 70561
+Young, G.R. 70597
+Young, J.A. 71835
Young, J.S.+ 73699
Young, J.S.+ 74165
+Young, S.G. 73228
+Young Ku Yoon 73274
Young-Kwon Sung+ 72514
+Youngblood, D.H. 70618
Youssef, T.H.+ 73106
+Yu, K.L. 71119
+Yu, K.O. 73079
+Yu, K.S. 73146
+Yu, M.L. 72929
+Yu Chao-fan 70565
Yu Chien-fan *see* Chien-fan Yu
+Yu Gui-fang 71129
+Yu Mei-fang 72976
Yu Shing-nan+ 73361
+Yu Shiying 71028
+Yu Shiying 71031
Yu-Chen Gao *see* Gao Yu-Chen
Yu-Kang Zhou+ 73230
Yu-ling Zhang *see* Zhang Yu-ling
Yu-ping Ho *see* Ho Yu-ping
Yu-ping Zhou *see* Zhou Yu-ping
Yu-shan Huang *see* Huang Yu-shan
Yu-shun Zhang *see* Zhang Yu-shun
Yu-ying Huang *see* Huang Yu-ying
Yu-yun Ni *see* Ni Yu-yun
Yuan Shi-xin+ 72976
Yuan-zhen Zhu *see* Zhu Yuan-zhen
+Yuasa, Y. 73303
+Yudin, A.B. 73162
+Yudin, S.G. 70929
Yuguang Xu *see* Xu Yuguang
Yuh-gong Yeh *see* Yeh Yuh-gong
+Yukov, E.A. 71029
+Yukov, E.A. 73330
+Yulchiev, A. 70406
+Yu.M. 73951
Yun-qi Chen *see* Chen Yun-qi
Yun-yu Wang *see* Wang Yun-yu
+Yung, D.K. 70900
Yung-gui Li *see* Li Yung-gui
+Yurchakevich, E.E. 72381
+Yurkov, Yu.S. 71547
Yushin, A.Ya. 71515
+Yushkevich, Yu.V. 70427
+Yusubov, F.M. 71070
Yutani, N.+ 71629
Yuuhaku, S.+ 73054

+Zabokrzycka, A. 70844
Zabrodin, A.V.+ 73800
Zaccaria, F.+ 69932
+Zaccaria, F. 70277
Zaeschmar, G. 72149
+Zagromski, S. 70606
Zahir, M.S. 70359
+Zahm, J.M. 73620
+Zaichenko, S.G. 73135
+Zaichik, L.I. 71525
Zaiitsev, G.O. 72336
Zaikin, A.D.+ 72551
+Zaimovskii, V.A. 73082
+Zaiser, C. 70399
+Zajac, M. 71091
+Zak, E.I. 70161
Zake, M.V.+ 71709
Zakharchenko, E.N. 73837
Zakharchenko, I.G.+ 73105
Zakharchenya, B.P.+ 72707
Zakharov, N.S.+ 71603
Zakharov, S.B.+ 71589
+Zakharova, K.P. 70680
Zakharova, M.I.+ 73086
Zakrzhevskii, A.E. 69873
+Zakula, R. 72369
+Zalesak, J.F. 71319
+Zaleski, S. 71964
Zalewska, A.+ 70266
+Zalewski, K. 70266
+Zambelli, G. 73121
+Zambelli, G. 73134
Zamoni, R.+ 72820
+Zamorani, G. 74172
+Zamorani, G. 74173
+Zamyshlyaev, B.V. 71760
Zandbergen, H.W.+ 71944
+Zane, L.I. 69836
+Zaneveld, J.R.V. 73821
Zanevsky, J.V.+ 70750
Zange, E.+ 70663
+Zanotti, L. 70383
+Zanotti, L. 70499
Zao Ngueng Mong *see* Ngueng Mong Zao
+Zapasskii, V.S. 72713
Zardecki, A.+ 73922
Zardini, P.+ 73611
+Zarembo, L.K. 72051
+Zarembowitch, A. 72055
+Zaretsky, A.A. 73584
+Zarubo, S.V. 72352
+Zashikhin, M.N. 73503
+Zaslavskii, S.L. 72901
Zatsepina, G.N.+ 73555
+Zauer, K. 71740
+Zavilopulo, A.N. 70754
+Zayachky, V.J. 70413
Zayats, A.A.+ 70396
+Zayats, N.S. 72421
+Zayats, N.S. 72848
Zborowski, M. 73682
Zdravkovich, M.M. 71560
Ze Feng *see* Feng Ze
Ze Fing *see* Fing Ze

+Zedalis, M.S. 71962
+Zee, A. 74194
+Zeidman, B. 70638
Zeilik, M.+ 74110
+Zeilik, M. 69823
+Zeilinger, A. 70738
+Zel'dovich, B.Ya. 71071
Zelenin, V.N.+ 74055
+Zeliger, K. 70751
+Zemlyanov, M.G. 72064
Zen Nan Xue ...... *see* Xue Zen Nan
Zengliang Cai ...... *see* Cai Zengliang
+Zeppenfeld, D. 70623
+Zerbi, G. *(ed.)* 69802
+Zgura, V.S. 72142
Zhang, Y.Z. 69876
+zhang Ching-Zhe 73361
+Zhang Hong-jun 70110
+Zhang Hong-jun 71173
Zhang Shu-Lin+ 71870
+Zhang Shu-yu 69983
Zhang Ui Fei ...... *see* Ui Fei Zhang
+Zhang Wei-bao 71497
+Zhang Wei-yue 71361
Zhang Wen 71426
+Zhang Wen-zhi 71087
+Zhang Wenqi 71745
Zhang Xia-ti 71462
Zhang Yang-zhung 71765
+Zhang Yi 71028
+Zhang Yi 71031
Zhang Yi-Cheng 70214
Zhang Yi-Cheng 70217
+Zhang Yi-Cheng 70221
+Zhang Yu-ling 72638
+Zhang Yu-shun 69937
Zhang-da Lin ...... *see* Lin Zhang-da
Zhao, J.G.+ 71896
Zhao Ming+ 73860
Zhao Qing-lan+ 71914
Zhao Te-Xiu ...... *see* Te-Xiu Zhao
+Zhao You-xiang 72528
+Zhao Zhiyong 70280
Zhao-chang Zheng ...... *see* Zheng Zhao-chang
Zharinov, A.V.+ 71747
Zharkikh, Yu.S.+ 72505
+Zharkov, A.Yu. 70362
+Zharkov, G.F. 72551
+Zhdan, P.A. 72216
+Zheludev, N.I. 71174
Zhen-bang Kuang ...... *see* Kuang Zhen-bang
Zhen-ming Wang ...... *see* Wang Zhen-ming
Zhen-xing Liu ...... *see* Liu Zhen-xing
+Zheng Zhao-chang... 71411
Zheng-Yu Peng ...... *see* Peng Zheng-Yu
+Zhernov, A.P. 72064
+Zheru, I.I. 72868
Zhi-xiong Hu ...... *see* Hu Zhi-xiong
Zhi-yi Liu ...... *see* Liu Zhi-yi
Zhiber, A.V. 69934
+Zhigalkin, A.K. 71142
Zhikharev, M.I.+ 70680
Zhiming Chen ...... *see* Chen Zhiming
Zhivopistsev, F.A.+ 70532
Zhiyong Zhao ...... *see* Zhao Zhiyong
Zhizhan Xu . *see* Xu Zhizhan
Zhizhin, G.N.+ 72878
+Zhizhin, G.N. 71876
Zhong-ming Lu ...... *see* Lu Zhong-ming
Zhong-Xian Huang+.. 70910
Zhou, X.+ 71592
+Zhou, Y. 72866
Zhou Li-wei+ 71064
+Zhou Pei-zhen 73434
+Zhou Qing-lian 71952
Zhou Sun Hong ...... *see* Sun Hong Zhou
+Zhou Xianjian 70292
Zhou Xiao-qian 70470
Zhou Yu-Kang.. *see* Yu-Kang Zhou
+Zhou Yu-ping 71129
+Zhu, F. 71592
+Zhu Qingshi 71028
+Zhu Qingshi 71031
Zhu Yuan-zhen+ 72297
Zhu-kun Guo ...... *see* Guo Zhu-kun
Zhuen-xion Chen ...... *see* Chen Zhuen-xion
+Zhukhovitskii, E.M. .71547
Zhukov, V.M.+ 72969
+Zhukova, Z.D. 73155
Zhukovskaya, A.E.+... 72185
Zhurilenko, B.E. 72594
Zi-yuan Ouyang.. *see* Ouyang Zi-yuan
Ziebeck, K.R.A.+ 72611
Ziebeck, K.R.A.+ 72610
Zielinski, J.+ 72290
Zielinski, P.G. 73026
+Zielinski, T. 72265
Zierold, K. 73703
+Zikmund, J. 71131
+Zikry, M.B. 73106
+Zimin, P.A. 73255
+Zimkina, T.M. 70899
+Zimmerer, G. 70897
Zimmerman, M.L.+ ... 70796
Zimmermann, C. 73216
+Zinchenko, S.I. 71633
Zinin, V.A. 70050
+Zinn, B.T. 71625
+Zinov'ev, G.M. 70324
Ziolkowska-Pawlak, B.+ 72523
+Zirin, H. 74058
+Zisk, S.H. 74011
Zisman, A.N.+ 70047
+Zisman, M. 70595
+Zisman, M.S. 70578
+Zitelli, V. 74173
+Zittel, J.D. 73786
+Zitter, R.N. 69835
+Zivopistsev, F.A. 70538
+Zmarzly, F. 71254
Zochowski, A.+ 71371
+Zoler, D.I. 71713
Zolotarevskii, I.V.+ 72649
+Zolotov, E.M. 71232
Zongyu Bao.. *see* Bao Zongyu
+Zorita, M.L. 70767
Zou Shi-chang+ 72013
+Zoz, E.I. 73155
+Zsoldos, B. 72280
+Zubarev, P.V. 73208
+Zubek, M. 71024
+Zubkov, L.Z. 72757
Zubov, B.V.+ 73526
Zuccarello, F.+ 70760
+Zucchi, F. 73250
Zuev, V.S.+ 71114
+Zulicke, L. 70980
+Zunder, D. 71740
+Zurabishvili, G.G. 73553
Zvalinskii, V.I.+ 73541
Zvarykina, A.V.+ 72381
Zverev, G.M.+ 72009
Zviadadze, M.D.+ 72712
Zvonkov, A.V.+ 71766
Zwart, S.T.de .. *see* de Zwart, S.T.
Zwier, T.S.+ 70938
+Zwislocki, J.J. 73609
Zykin, P.G.+ 71505
Zylbersztejn, A. 72496
+Zyukin, Yu.P. 71406
+Zyuzin, A.A. 73107

BIBLIOGRAPHY INDEX

^{13}C NMR chemical shift tensors of metal carbonyls, (58 refs.) 72690
Adsorption and reactions of CO, NO, H$_2$ and O$_2$ on group VIII metal surfaces, (111 refs.) 73369
Alkali metal chloride aqueous solutions, thermodynamic properties, (77 refs.) 73359
Application of differential reflectometry, (88 refs.) 70108
Auger electron spectroscopy, (51 refs.) 72897
Binary stars, (163 refs.) 74116
Coiolis intensity perturbations of the ν_4 band of SF$_6$, (50 refs.) 70838
Compact toroid confinement and stability, (51 refs.) 71780
Computer modelling of amorphous magnetic materials, (107 refs.) 71881
Convection in melt growth, (76 refs.) 71915
Cosserat continuum theory applied to bone, (52 refs.) 73625
Creep, crack and cavity nucleation, (83 refs.) 73145
Creep, grain boundary sliding, (55 refs.) 73197
Creep strength, high temperature, (53 refs.) 73148
Crystal growth of refractory compounds from solutions in metallic melts, (175 refs.) 72979
Dielectric-semiconductor structures, (93 refs.) 72507
Dose-rate effects in mammalian cells. IV. Repairable and nonrepairable damage in noncycling C3H 10T$^1/_2$ cells, (69 refs.) 73640
Drag reduction and mechanical degradation in polymer solutions in flow, (57 refs.) 71608
Dynamics of surface atoms and molecules under irradiation, (58 refs.) ... 72227
Earthquake prediction, (136 refs.) 73739
Electromechanical and physicochemical properties of connective tissue, (260 refs.) 73624
Electron beam blanking systems, (36 refs.) 70156
Film models for multicomponent mass transfer, (49 refs.) 70020
Galactic distance scales, (87 refs.) 74138
Galaxy collisions, (82 refs.) 74160
Gem materials, natural and artificial, (137 refs.) 73793
Grain-boundary diffusion in metals, (130 refs.) 72170
Growth of dislocation-free bulk silicon crystals, (81 refs.) 72982
H cracking in Zr and alloys, (143 refs.) 73176
Heavy-ion atomic physics. The decay of the vacuum and intermediate molecules, (156 refs.) 70581
Heavy ions as nuclear probes, (333 refs.) 70743
HH 1, HH 2 and Cohen-Schwartz star, (66 refs.) 74067
II-V semiconductor epitaxial layers characterisation, (140 refs.) 72267
In-beam gamma-ray spectroscopy with heavy ions, (202 refs.) 70742
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Nuclear waste management; Boston, MA, USA, 16-19 Nov. 1981, *S.V.Topp (editor/s),* [New York, USA: North-Holland 1982] 69789 (introductory abstract), 70698–705

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Phoenix conference on computers and communications, '83; Phoenix, AZ, USA, 14-16 March 1983, *(IEEE)* [New York, USA: IEEE 1983] 73993

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Photovoltaic specialists conference; San Diego, CA, USA, 27-30 Sept. 1982, [New York, USA: IEEE 1982] 72983–4, 73093, 73426–7, 73440–55

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Physics of semiconductors; Montpellier, France, 6-10 Sept. 1982, *(IUPAP; Societe Francaise de Physique; European Phys. Soc)* [March 1983] 69780 (introductory abstract), 71126, 71983, 72291, 72305–7, 72315–25, 72329, 72340, 72346–8, 72357, 72363, 72398, 72434–6, 72496, 72722, 72754–5, 72804–7, 72824–5, 72830–2, 72836, 72842, 72860–3, 72949–51

Plasma physics; Goteborg, Sweden, 9-15 June 1982, [1982] 70724–5, 71699–701, 71711, 71729, 71733–4, 71744, 71749, 71752–3, 71756, 71775–82, 71799–800

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Sintering, theory and practice; Portoroz, Yugoslavia, 7-10 Sept. 1981, *D.Kolar, S.Pejovnik, M.M.Ristic (editor/s),* [Amsterdam, Netherlands: Elsevier 1982] 72973, 73021–2, 73031, 73050–2, 73057

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Sound broadcasting; Mannheim, Germany, 23-25 Nov. 1982, [1983] 70084, 71314, 73628

SOUTHEASTCON '83; Orlando, FL, USA, 11-14 April 1983, [New York, USA: IEEE 1983] 72648, 72775

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63.00 Lattice Dynamics and Crystal Statistics
64.00 Equations of State, Phase Equilibria, and Phase Transitions
65.00 Thermal Properties of Condensed Matter
66.00 Transport Properties of Condensed Matter (Nonelectronic)
67.00 Quantum Fluids and Solids; Liquid and Solid Helium
68.00 Surfaces and Interfaces; Thin Films and Whiskers

70.00 **Condensed Matter: Electronic Structure, Electrica Magnetic, and Optical Properties**

71.00 Electron States
72.00 Electronic Transport in Condensed Matter
73.00 Electronic Structure and Electrical Properties of Surfaces, Interfaces, and Thin Films
74.00 Superconductivity
75.00 Magnetic Properties and Materials
76.00 Magnetic Resonances and Relaxation in Condensed Matter; Mossbauer Effect
77.00 Dielectric Properties and Materials
78.00 Optical Properties and Condensed Matter Spectroscopy and other Interactions of Matter with Particles and Radiation
79.00 Electron and Ion Emission by Liquids and Solids; Impact Phenomena

80.00 **Cross-Disciplinary Physics and Related Areas of Science and Technology**

81.00 Materials Science
82.00 Physical Chemistry
86.00 Energy Research and Environmental Science
87.00 Biophysics, Medical Physics, and Biomedical Engineering

90.00 **Geophysics, Astronomy and Astrophysics**

91.00 Solid Earth Geophysics
92.00 Hydrospheric and Atmospheric Geophysics
93.00 Geophysical Observations, Instrumentation, and Techniques
94.00 Aeronomy and Space Physics
95.00 Fundamental Astronomy and Astrophysics, Instrumentation and Techniques and Astronomical Observations
96.00 Solar System
97.00 Stars
98.00 Stellar Systems; Galactic and Extragalactic Objects and Systems; The Universe